

AUTOMOTIVE *and Aviation* INDUSTRIES

SEPTEMBER 1, 1944

SERIAL RECORDS
SEP 11 1944

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Ball Bearings to destroy Ball Bearings

● At least twenty ball bearing plants in fourteen or more cities of Fortress Europe have been blasted again — and again — as the quickest way to stall most enemy war production. Because wherever shafts turn, for the enemy as well as for us, ball bearings are utterly indispensable.

And this continuing job is being done by thousands of great bombers — each functioning with thousands of ball bearings, from nose to tail.

They are vital parts of every plane, tank, warship, fire control, landing craft. Even after breaking world's production records, New Departure is still hard pressed to satisfy the demands of our Army, Navy, and our Allies.

Such an unprecedented demand is an accurate index of ball bearing efficiency in bearing the loads, maintaining precise location of moving parts, reducing friction and wear to an absolute minimum.

A New Departure engineer is your assurance of bearing performance. Consult him.

New Departure, a Division of General Motors, Bristol, Connecticut.

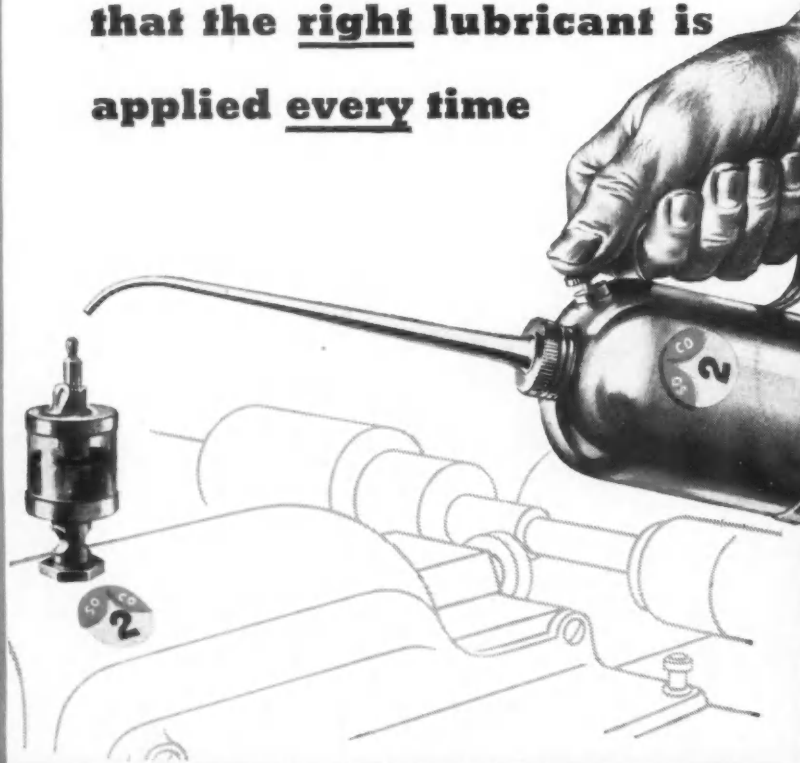
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Cut-away view of
New Departure
Ball Bearing

nothing rolls like a ball
NEW DEPARTURE
BALL BEARINGS

SEP - 9 1944

**An easy way to make sure
that the right lubricant is
applied every time**



Standard Coded Lubrication Service

CODED LUBRICATION is one of the most important forward steps to insure better lubrication that has been made in many years.

In spite of past progress in producing better lubricants and the time spent developing better methods of application, one question still remained—was the *right* lubricant used on *every* application *every* time?

Now Standard Coded Lubrication Service answers this question completely. A simple lubricant numbering system makes it practically impossible for a conscientious oiler crew to misapply lubricants.

Standard Coded Lubrication Service is described at the right. Note these advantages over other systems you may have tried.

1. Only two color combinations and simple numbered decals are used to designate various lubricants.
2. The color combinations, red and yellow, and blue and yellow are easy to distinguish in any light.

3. The numerals are easy to recognize and remember even by those who do not know English.

4. Only one simple record is needed, which is made up when the system is installed. There are no complicated forms to fill out or keep up to date.

5. The code numbers used, apply only to the lubricant used in your plant and not to SAE or the maker's brand or grade numbers.

Send for the booklet fully describing Standard Coded Lubrication Service. If your plant is located in the Middle West a Standard Oil Industrial Service Representative will be glad to discuss this system with the men in charge of your lubrication.

*Gasoline Powers the Attack . . .
Don't Waste a Drop!*

FREE BOOKLET TELLS HOW

this simple code system may be fitted to your lubrication plan:

Flexibility and adaptability are outstanding features of this system. Note that it is a *numerical* system not to be confused with complex "color scheme" systems. Here are the few simple steps in this plan. A code number is assigned to each lubricant in your plant. Numbered decalcomania transfers are furnished by us in quantities sufficient to be applied to:



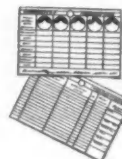
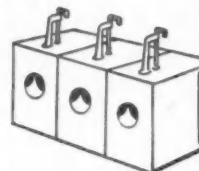
—every point of lubrication on every machine

—every grease gun or oil can used in servicing equipment



—every container or drum on your lubrication cart where they are used

and every barrel, drum, or storage tank in your oil house.



Machine Record Cards: Where desired, a supply of machine record cards (4" x 6") is provided.

Lubrication Chart: For control purposes, a card is provided to list, by brand name and code numbers, all lubricants used in the plant. This card is used by stock clerk or stock-keeper to enable him to requisition products by brand name, and to mark barrels with the correct code numbered decal.



This Booklet gives full details of how Standard Coded Lubrication Service can go to work in your plant. Ask your Standard Oil Man for a copy. Talk it over with him and the men in charge of your lubrication. See how this plan fills a gap in your lubrication program. Call the nearest Standard Oil Company (Indiana) office, or write 910 S. Michigan Avenue, Chicago 80, Illinois. In Nebraska, write Standard Oil Company of Nebraska at Omaha 2.

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**STANDARD
SERVICE**

★ LUBRICATION ENGINEERING

Ordnance plant going up!



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designed transmission units for famous machines with big loads to lift. If you have a job with exacting space limitations, one which an ordinary gearbox can't handle . . . send details of your problem!

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of
Dependable
Service

COTTA

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NICKEL AIDS IN THE AUTOMOTIVE INDUSTRY

to SPEED 'EM UP!

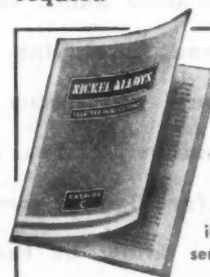
The ingenuity and experience of automotive engineers made possible the design of military vehicles, engineered for quality and quantity production in numbers that amazed the world. This kind of engineering-thinking pioneered the application of Nickel alloyed materials and foreshadows new achievements in the realm of peacetime automotive transportation.

In steering knuckles or differentials, in forged gears or cast blocks,

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For years the technical staffs of International Nickel have been privileged to cooperate with automotive engineers and production men. Counsel, and printed data about the selection, fabrication and

heat treatment of ferrous and non-ferrous metals is available upon request.



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★ **Nickel** ★

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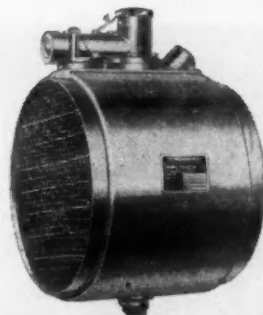
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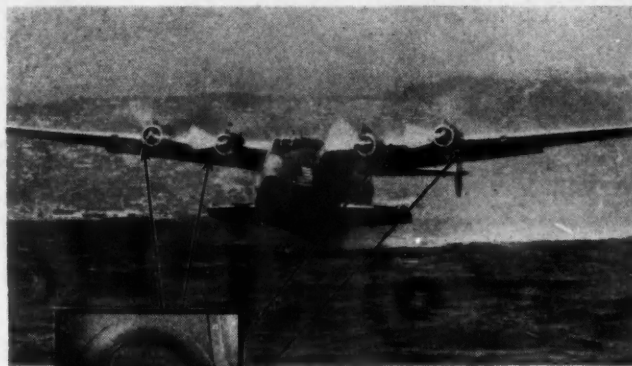
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September 1, 1944

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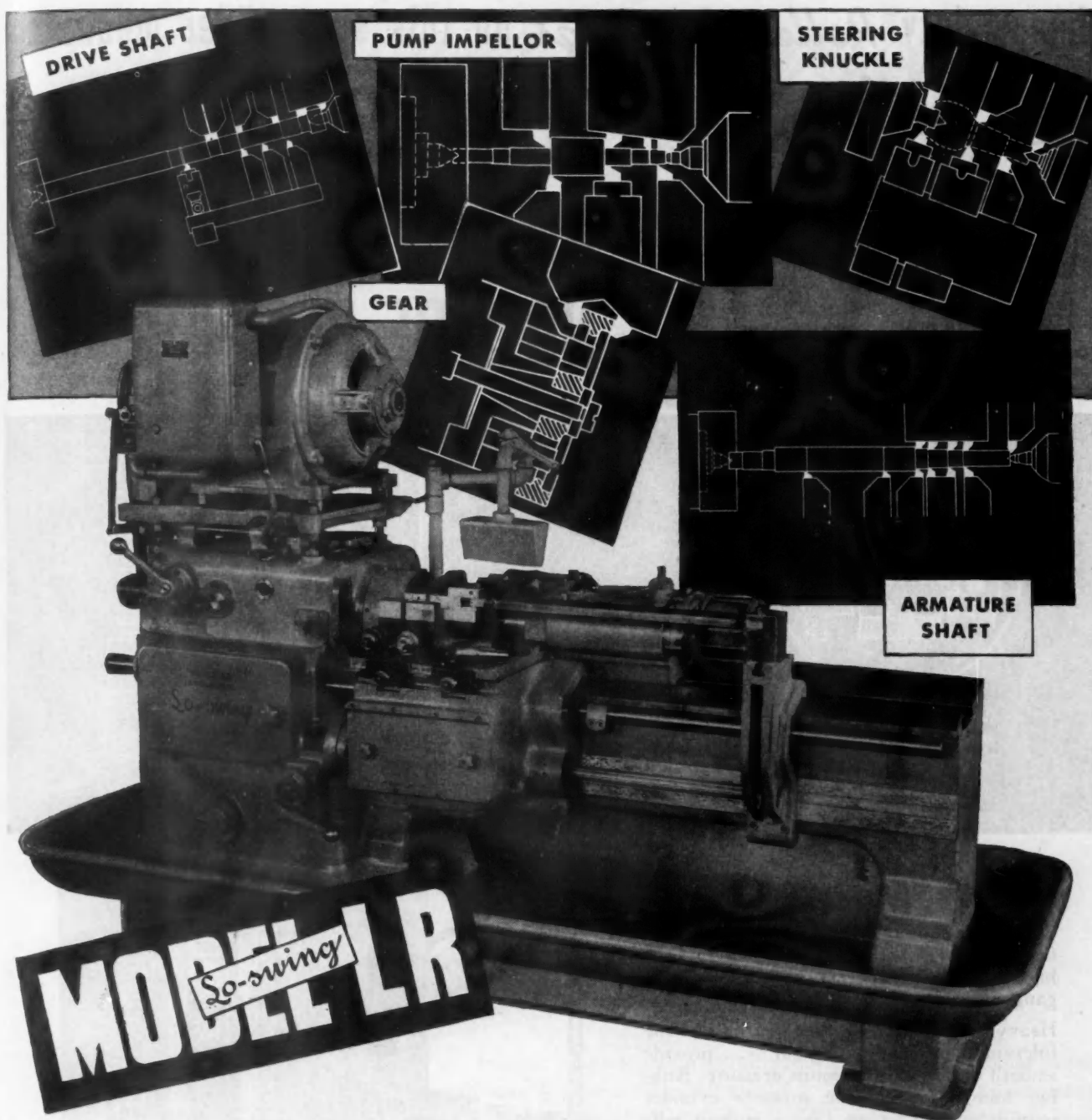
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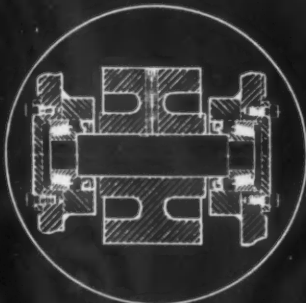
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LATHE NEWS *from* SENECA FALLS

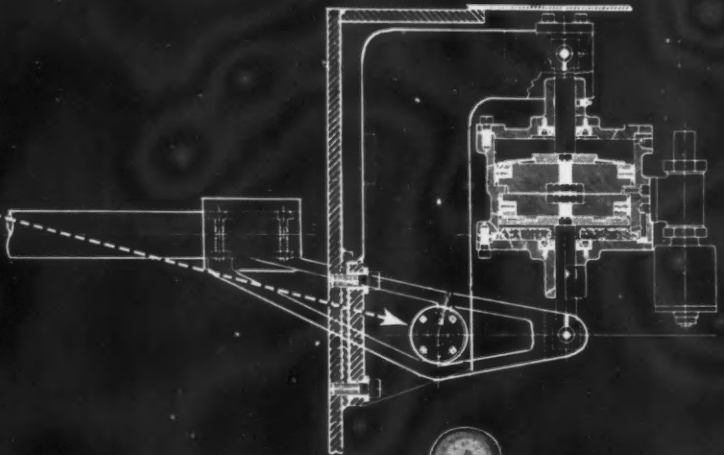
heavy duty *Roller Bearings* on this spotwelder mean:



- * **LESS MAINTENANCE**
- * **SMOOTH ACTION**
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Cross-section at fulcrum point
showing use of heavy duty
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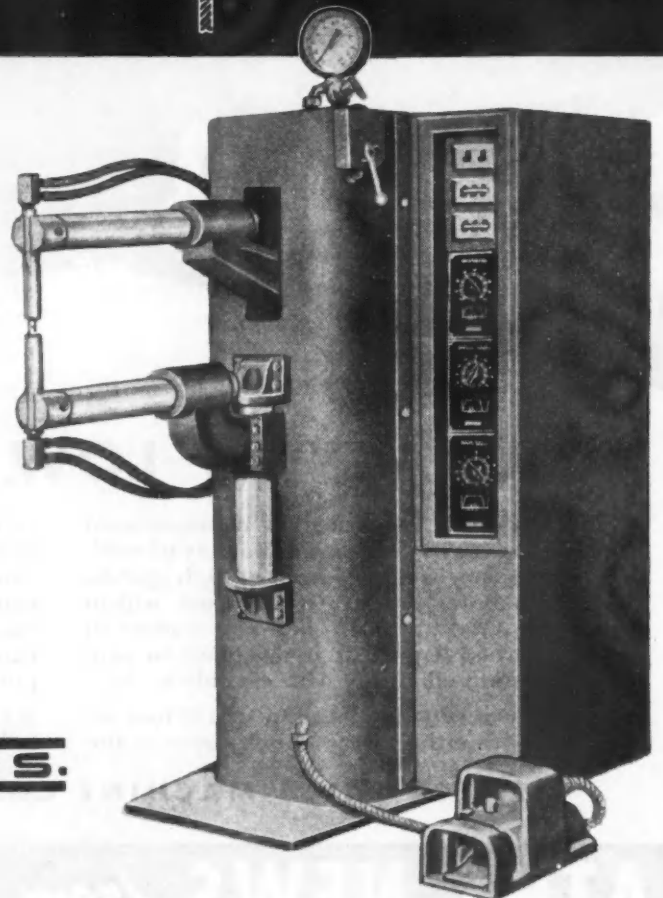
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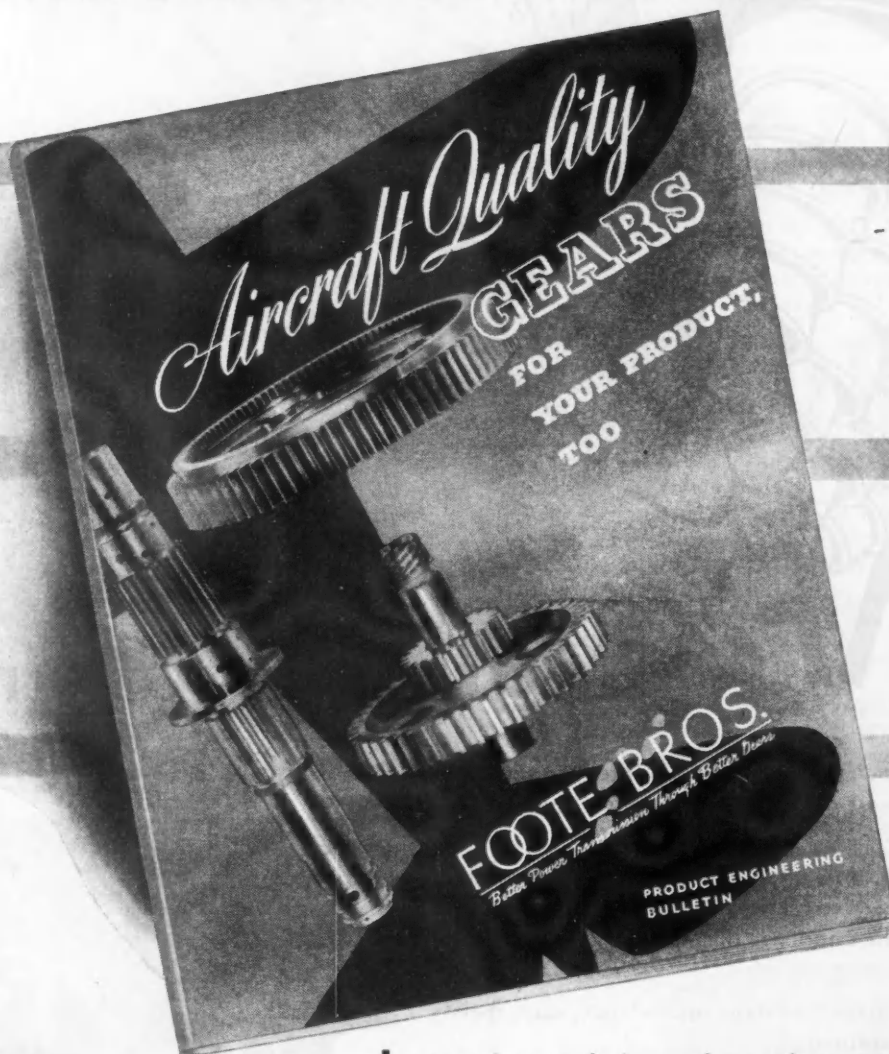
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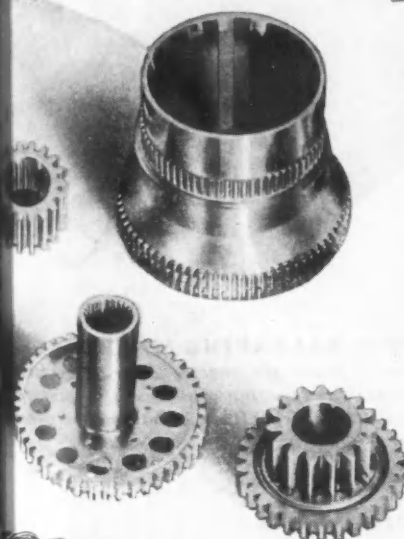
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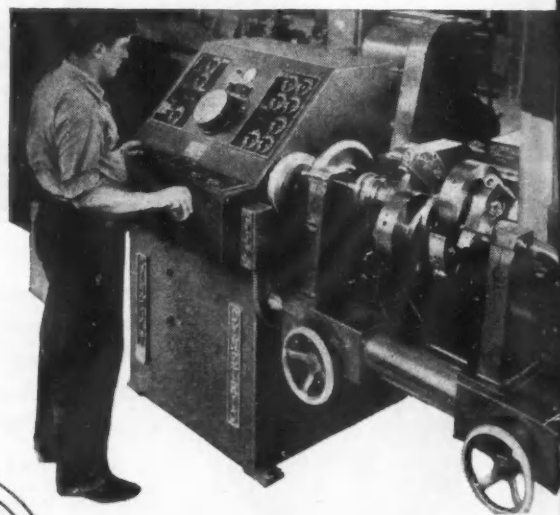
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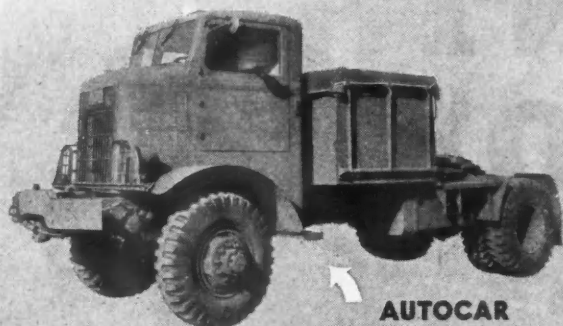
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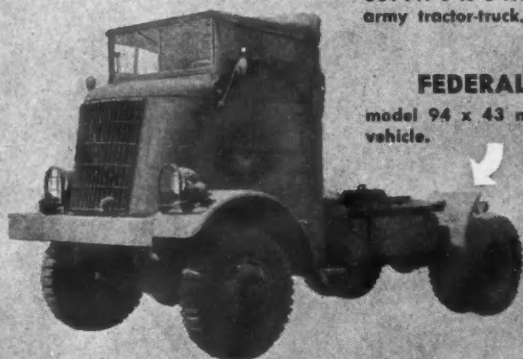
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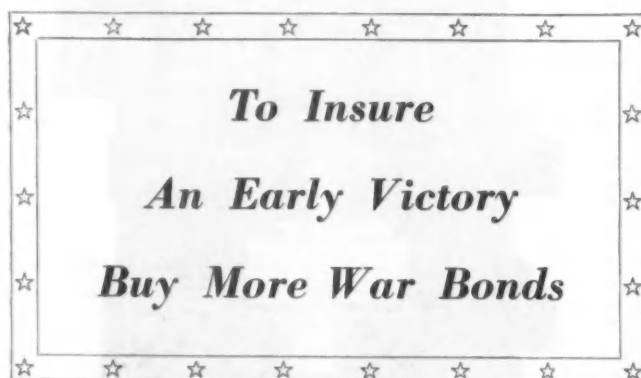


Swift progress is in the air as warfare in the Pacific is widened to wrest strategic outposts from the Japs. At Saipan and Guam, Curtiss Navy Helldivers spewed death and destruction on enemy strongholds to cover the landings of our troops and pave the way for quick, decisive victory. This amazing Curtiss Navy Helldiver is the product of many converging efforts including the wartime skills developed by the worker-fighters of—



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METAL CRAFT
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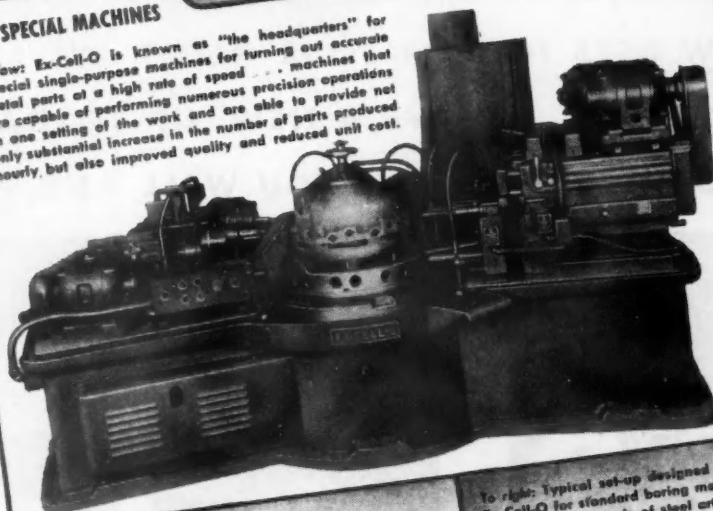
A File of EX-CELL-O Production Aids

STANDARD MACHINES

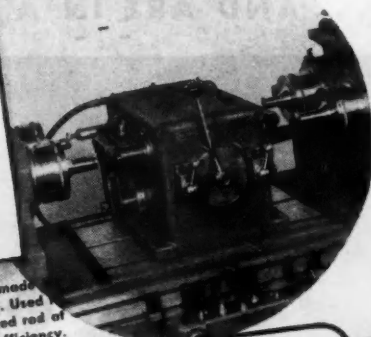
Ex-Cell-O precision machine tools—for boring, turning, facing, thread grinding, broach sharpening, tool grinding, lapping—are sound in design and construction. The simplicity of their operation and the substantial production they attain on an economical basis, make these Ex-Cell-O standard machines of

SPECIAL MACHINES

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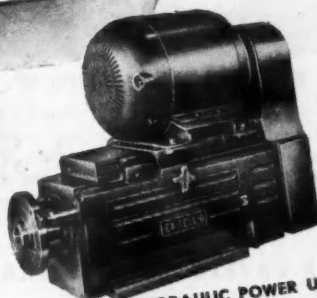
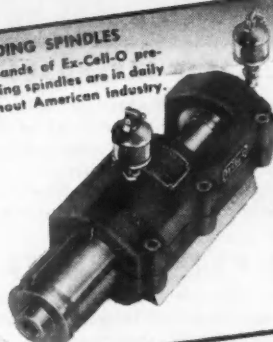
FIXTURES



To right: Typical set-up designed and made by Ex-Cell-O for standard boring machine. Used to semi-finish both ends of steel articulated rod at a high production rate with maximum efficiency.

GRINDING SPINDLES

Many thousands of Ex-Cell-O precision grinding spindles are in daily use throughout American industry.

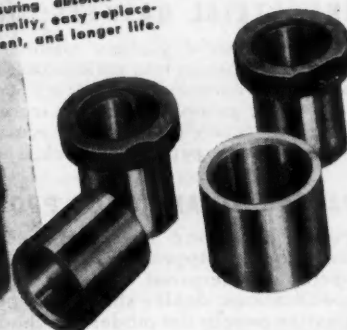


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They provide an economical method of drilling, reaming, counter-sinking or spot-facing. Also may be used as prime movers or drivers for other machine units.

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Ex-Cell-O drill jig bushings (A.S.A. Standards) are made with accuracy, assuring absolute uniformity, easy replacement, and longer life.



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DETROIT 6, MICHIGAN

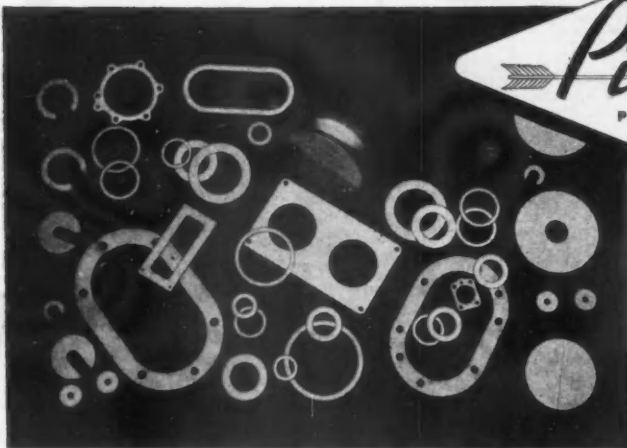
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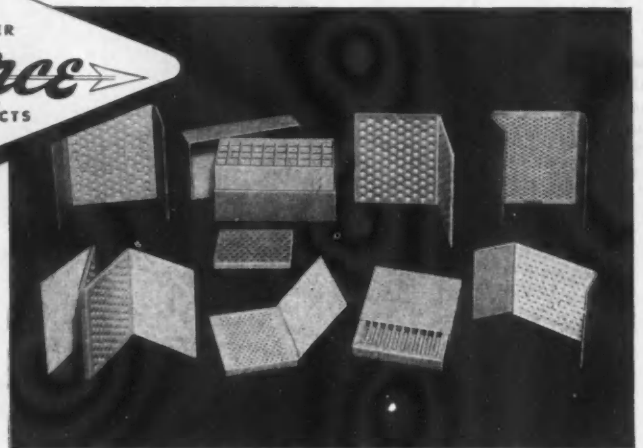


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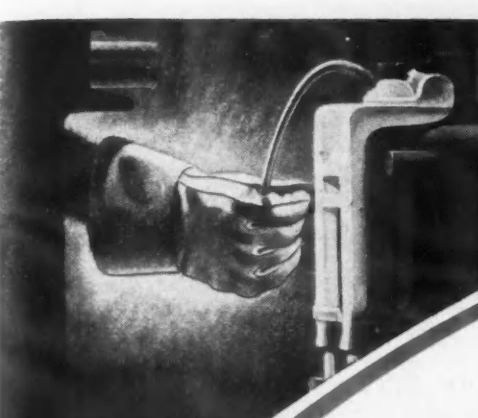
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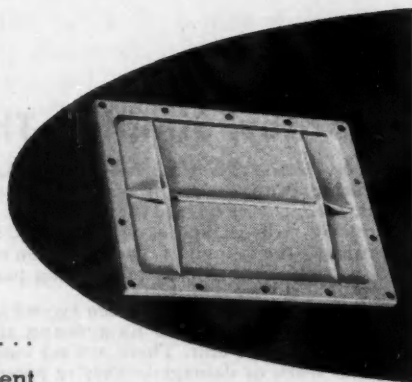


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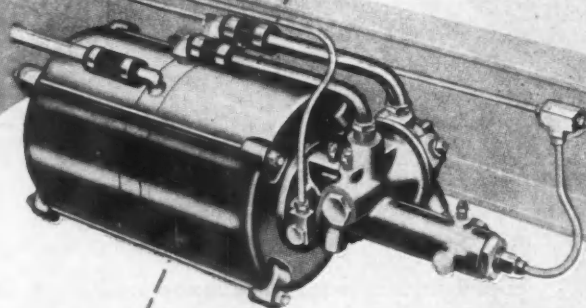
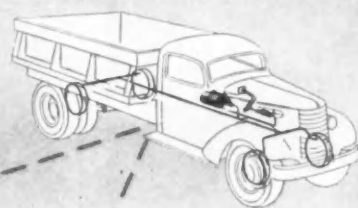
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13

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BENDIX PRODUCTS DIVISION OF BENDIX AVIATION CORPORATION, SOUTH BEND 20, INDIANA



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Here are all the facts and the procedure. Get posted for the day is not far off when you will wish you had.

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This piece of equipment has saved time and cut corners in the production of B-24 bomber parts. It was built for the Ford Motor Co. by the University of Michigan engineering department. Much is expected of it in the times to come.

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Two more pages of those time savers that have been printed from time to time in these pages and have proved so popular.

**AUTOMOTIVE
INDUSTRIES**

Reg. U. S. Pat. Off.

Planned Economy

By Julian Chase

IT WOULD seem that advocates of all-inclusive national economic planning must certainly have received, during these past few years, some rude shocks of sufficient severity to all but, if not quite, shatter their belief in the practical effectiveness of their pet theories. It would seem so, but there is no way of really determining how great a force of fact or experience is necessary to penetrate minds of that particular type.

In the life of a nation, ten years is a short time in any period of history. Relatively, it is a shorter time now than it was a hundred years ago. And, from here on, with our accelerating rate of development, it will become progressively shorter measured in terms of change and accomplishment. But consider the flood of upsetting circumstances that have nullified the humanly shortsighted vision of leaders and planners during the ten years just past. What will the next ten years bring? Is there any one who can say?

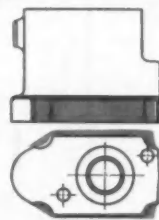
No one, of course, can say now what plan destroyers will develop in the next ten years because there is no such thing as omniscience among human beings, and omniscience or something very close to it is a prerequisite of successful all-inclusive national planning for a period even so short as ten years. Mussolini planned, and what did he come to? Hitler planned, and what is he coming to? Both had all that any planner could hope for in means for planning and methods of execution. They drew on the best brains their nations provided. They generated great powers of compulsion without which such planning is of no avail. They chose a relatively simple major objective—conquest. They built with one end in view and provided themselves with what their reason and best judgment told them were adequate means for its attainment. But being in reality merely human they were utterly unable to measure adequately the extent and power of their opposition. They failed as all long range planners on a grand scale must.

Ten years ago, or even five years ago, did our leaders see what was coming? Obviously, quite obviously, the answer is no. If they had, we should have used relatively more, rather than less, of our total federal government expenditures during that period for military preparations. But we did not. In the fiscal years, 1929 to 1933, inclusive, 18.25 per cent of our governmental expenditures were for military purposes. In

(Turn to page 100, please)

JUST A SLIGHT DIFFERENCE in TECHNIQUE

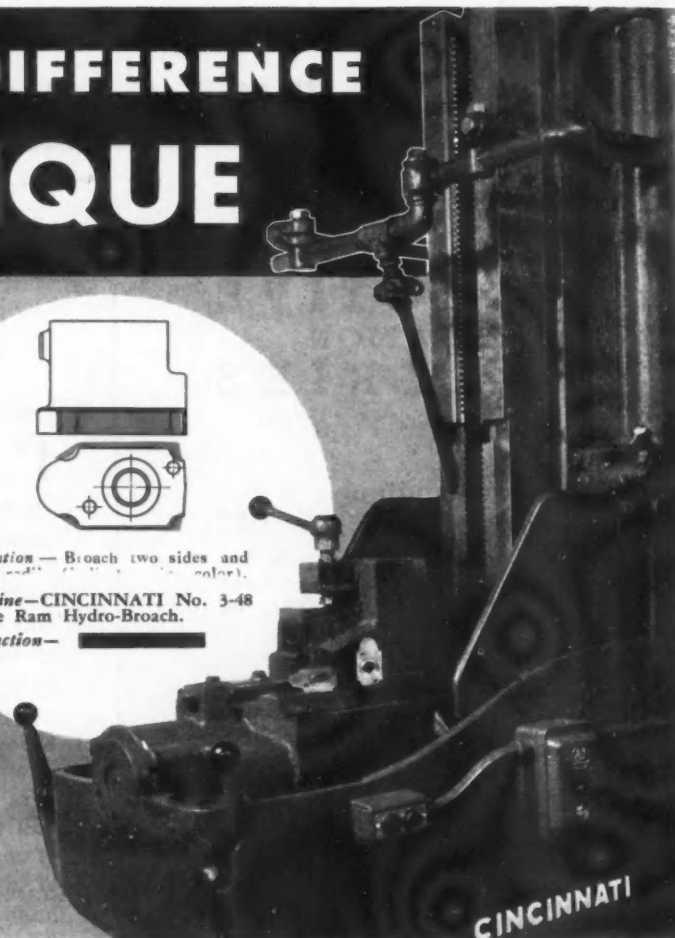
made
this
BROACHING
job



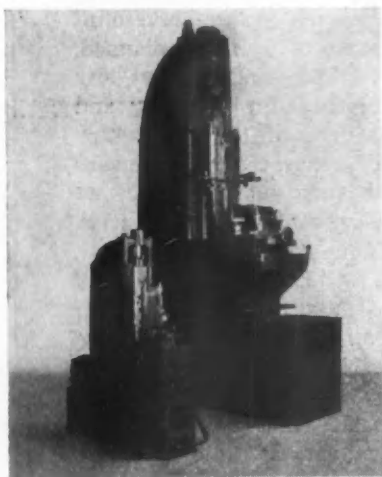
Operation — Broach two sides and
four radii of the part (see detail).

Machine — CINCINNATI No. 3-48
Single Ram Hydro-Broach.

Production —



The broaching job illustrated here is one of those run-of-mine parts which could be tooled up in several ways, but a slight difference in the technique of adjusting four of the broaching inserts gives the set-up a unique advantage in economical production.



CINCINNATI Single Ram Vertical Hydro-Broach Machines, one ton and ten ton sizes. Complete specifications on all standard sizes may be obtained by writing for catalog No. M-886.

Four radii and two sides of the part are broached on a CINCINNATI No. 3-48 Single Ram Hydro-Broach. The four broaching tools for the radii are jackscrew adjusted rather than the conventional taper gib adjustment. This arrangement (for light cuts only) greatly facilitates adjustment to correct sizing dimensions after the tools have been ground; eliminates skimming of excessively worn tools.

A minor item, you might say, in the complete equipment of machine, fixture and inserts, but CINCINNATI Application Engineers are accustomed to analyzing the customer's job from every angle, from the machine down to smallest details. These engineers will be glad to work with you on your surface finishing problems, war and post-war.



THE CINCINNATI MILLING MACHINE CO. CINCINNATI, 9 OHIO, U.S.A.

TOOL ROOM AND MANUFACTURING MILLING MACHINES... SURFACE BROACHING MACHINES... CUTTER SHARPENING MACHINES

Profit Margins Continue at Low Level

By Frederick C. Crawford

Chairman of the Board,
National Association of Manufacturers;
President, Thompson Products, Inc.

AMERICAN business is making money and the American conscience is troubled. It is troubled because this is wartime and men are dying on the roads that lead from the beachheads to Berlin. There can never be equality of sacrifice between sons who fight and civilians who stand on the sidelines. The essential humanity of that concept colors every phase of our lives today.

All our facts are leading double lives—first as they appear blurred by war-born emotions, second, as they actually exist. But America's conscience concerning business profits would be less troubled if there were more facts and less politically inspired implications concerning them.

Actually profit margins in this nation have been coming down steadily since the early days of the National Defense period. No "war millionaires" are being made in anything like 1917 quantities. No taxpayers are being milked on the operation of Government-owned plants. The big figures seen in the press merely reflect the giant job this country's producers have done.

This is 1944. The Jap is pinned back on his homeland, far from our shores which no longer lie free to any taker. The storming of the Channel and the beaches of Fortress Europe moves ahead. Our side has the tools of its task in hand, enough of them to make an Eisenhower

predict victory in this year. Right or wrong on the timing, the rolling tide of American production has made the prediction valid.

Industry's job has been inventing, creating, and supplying the many things which comprise that production for victory. That job is well in hand. And, like the man who marched through the sandburrs, business and industry find it necessary to remove some of the thorns before moving onward to the equally immense task of providing jobs and national well-being for peace.

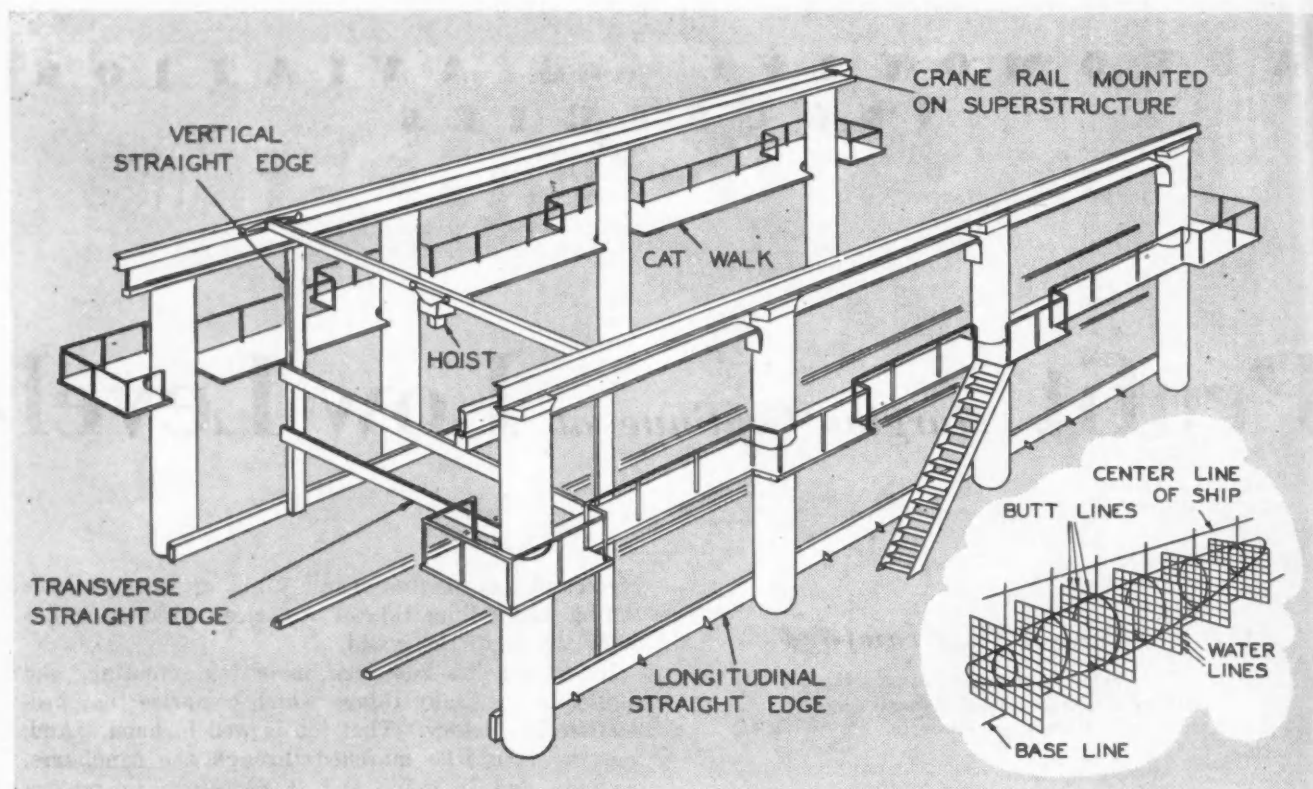
Of course, industry is making money. Production and the demand for it being the keys to the system that time has proved best for Americans, it would be a sad reflection upon industry's skills and ingenuity if it were not. Total industrial output has increased to more than double the 1939 level. It had to—and did. The world witnessed the most gigantic production job in human history.

It is not odd that the figures which attended the
(Turn to page 92, please)

Profits and Taxes of All Manufacturing Corporations in the United States (Dollar Figures in Millions)

| Year | Gross Receipts | Net Income Before Taxes and Before Reserves | Income Taxes | Net Income After Taxes but Before Reserves | Net Dividends Paid Out | Retained Earnings | Profit Margin | |
|------|----------------|---|--------------|--|------------------------|-------------------|---------------|-------------|
| | | | | | | | Before Taxes | After Taxes |
| 1917 | \$ 42,201 | \$ 5,559 | \$ 1,327 | \$ 4,232 | \$ 1,383 | \$ 2,849 | 13.2% | 10.0% |
| 1918 | 44,167 | 4,534 | 2,112 | 2,422 | 1,315 | 1,107 | 10.3 | 5.5 |
| 1919 | 52,290 | 4,853 | 1,360 | 3,493 | 1,262 | 2,231 | 9.3 | 6.7 |
| 1920 | 56,649 | 3,282 | 945 | 2,337 | 1,488 | 849 | 5.8 | 4.1 |
| 1921 | 38,442 | —121 | 352 | —473 | 1,324 | —1,797 | —3 | —1.2 |
| 1929 | \$ 71,640 | \$ 4,497 | \$ 544 | \$ 3,953 | \$ 2,579 | \$ 1,374 | 6.3% | 5.5% |
| 1930 | 58,178 | 1,197 | 317 | 880 | 2,616 | —1,736 | 2.1 | 1.5 |
| 1931 | 43,716 | —751 | 165 | —916 | 1,894 | —2,810 | —1.7 | —2.1 |
| 1932 | 31,845 | —1,727 | 100 | —1,827 | 1,121 | —2,948 | —5.4 | —5.7 |
| 1933 | 35,070 | 263 | 208 | 75 | 1,011 | —936 | .8 | .2 |
| 1934 | 40,768 | 1,043 | 266 | 777 | 1,224 | —447 | 2.6 | 1.9 |
| 1935 | 47,334 | 1,865 | 358 | 1,507 | 1,593 | —76 | 3.9 | 3.2 |
| 1936 | 56,431 | 3,185 | 609 | 2,576 | 2,411 | 165 | 5.6 | 4.6 |
| 1937 | 61,950 | 3,204 | 654 | 2,550 | 2,435 | 115 | 5.2 | 4.1 |
| 1938 | 50,824 | 1,266 | 377 | 909 | 1,344 | —435 | 2.5 | 1.8 |
| 1939 | 57,939 | 3,213 | 634 | 2,579 | 1,842 | 737 | 5.5 | 4.5 |
| 1940 | 67,400 | 4,944 | 1,534 | 3,410 | 2,027 | 1,383 | 7.3 | 5.1 |
| 1941 | 95,800 Est. | 9,936 | 4,946 | 4,990 | 2,090 | 2,900 | 10.4 | 5.2 |
| 1942 | 123,200 Est. | 12,543 | 7,879 | 4,664 | 1,760 | 2,904 | 10.2 | 3.8 |
| 1943 | 151,000 Est. | 14,750 | 9,900 | 4,850 | 1,945 Est. | 3,005 | 9.8 | 3.3 |

SOURCES: U. S. Treasury Dept. "Statistics of Income," and U. S. Department of Commerce.



Convair Tooling Dock

A REVOLUTIONARY new positioning device known as the Master Tooling Dock has produced savings in time and materials amounting to 50 per cent and more for Consolidated Vultee Aircraft Corp. at San Diego, Calif. The Master Tooling Dock was designed for use in setting up assembly tooling fixtures, master jig fixtures, and production check fixtures. It facilitates the precision duplication of lofting information, and permits automatic coordination in the making of both fixtures and prototypes assemblies. It eliminates the need for transits, surface plates, piano wire, oil bobs, scales, height gages, verniers, and similar instruments; simultaneously, it provides a precision checking means for mastering fixtures, and speeds up the job of duplicating previously-fabricated fixtures.

The function of the Master Tooling Dock is to reproduce lines of the grid plane system of the master loft by means of physical members called *straight edges*. There are four longitudinal straight edges which are level, parallel, and fixed to the base and superstructure of the dock. In addition, there are two vertical and two transverse straight edges which are movable. The longitudinal straight edges are used for length dimensions or station lines; the verticals, for height dimensions or water lines; the transversals, for width dimensions or buttock lines.

All straight edges have a series of 0.500 in. diam-

eter *index holes* jig-bored on 10.000 in. centers, which coincide with the lines of the grid plane system of the master loft. A master index drill bar is employed during the jig boring operation to provide perfect coordination for the grid line positioning of *strip templates*, *index templates*, and fittings without the use of other measuring instruments in the set-up of a fixture.

Component parts of the Master Tooling Dock are shown in Fig. 1. There are two dock units installed at San Diego; one has a length of 60 feet, while the other has a length of 20 feet. Loading rails run the

Fig. 2—(Right)—The ship stations are positioned. This operation is accomplished as follows: Strip template (a) is mounted on longitudinal straight edge (b) using ground dowel pins (c) through both the lower 1/2 in. holes in strip template and those of the longitudinal straight edge. Station fitting (d) is positioned by inserting ground dowel pin (e) through the margin hole (f) of the strip template into the dock station fitting hole; the ground dowel pin is rotated in the hole so that it will neither bind nor allow play. Station fitting (d) is bolted tight to the "T" slot in longitudinal straight edge (b); this step is repeated for each ship station location. Strip template (a) is removed and first three steps of the operation are repeated for the remaining three longitudinal straight edges, using the same strip template.

Fig. 1—The drawing at the left shows the component parts of Consolidated Vultee Aircraft Corp. master tooling dock at San Diego, Calif. The inset shows bulkheads in fuselage construction, superimposed upon grid line reference plates.

full length of the two units, which are placed end to end. Accessories required in the operation of the dock include station fittings, which are used to secure the vertical straight edges to the longitudinal straight edges so as to establish a true perpendicular transverse plane (parallel at any given position); dummy fittings, which are used to position fixture locators for machine fittings (each consisting of a standard body with provisions for matching the sex of the fixture fitting); index fittings, which are used to position the index template in proper relationship to the transverse straight edges; and offset gages, which are used for positioning when it is necessary to shift the vertical straight edge to overcome any interference with a fixture locator during dock set-up operations.

An index template is used to position contour locators in the third dimension, and to establish the relationship between the tooling holes in each part to be located in the assembly fixtures and the basic grid

lines. It is made of 0.125 in. sheet steel of proper height and width as required for different fixtures in accordance with lofting information of the master layout. Therefore, it might be called a metal layout of the body plan, except for the fact that tooling holes are superimposed rather than contour lines.

The master metal layout is reproduced by the Photo-print process on 0.062 in. steel template stock to be used for further tooling purposes; the result is known as the *master tooling layout*. Individual reproductions of the master tooling layout are superimposed over pins inserted in coordinating holes at grid intersections on an otherwise blank index template, and these are stack drilled at each of the tooling hole locations so as to transfer the exact locations of the tool holes to the index template.

Each index template has grid lines on 10.000 in. centers and the coordinating holes are reamed to 0.500

Speeds Production

By Leland A. Bryant

Consulting Engineer,
Consolidated Vultee Aircraft Corp.

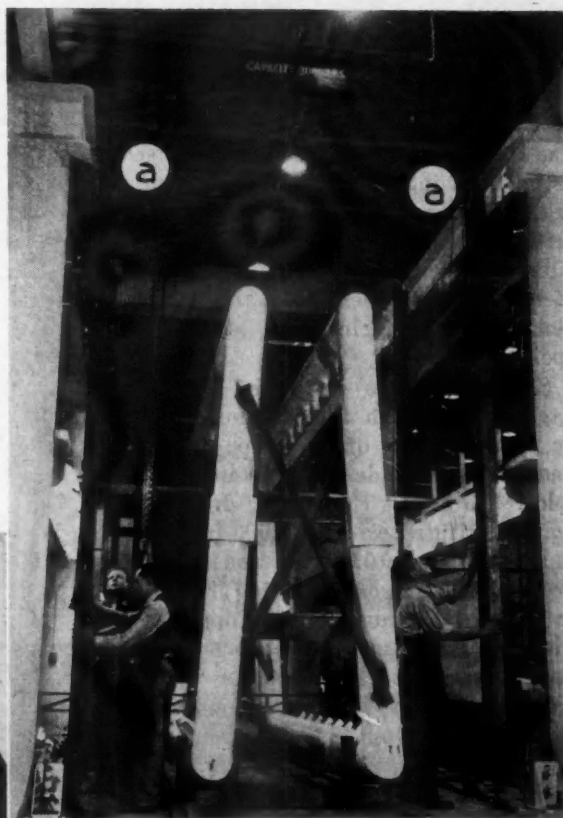
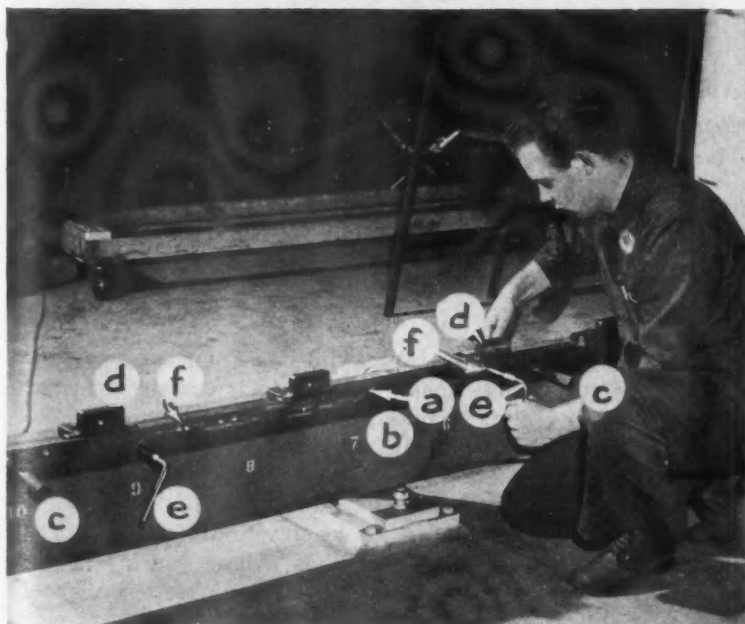


Fig. 3—(Above)—Vertical straight edges are moved to the first station. This operation is accomplished as follows: Over-head crane is attached by bolting lifting yoke (a) to each vertical straight edge. Straight edge is guided to proper location of first ship station. Straight edge is positioned to station fitting (lower left corner of illustration) by using ground dowel pin through holes in vertical straight edge and station fitting. Set-up is clamped tight by bolting to station fitting.

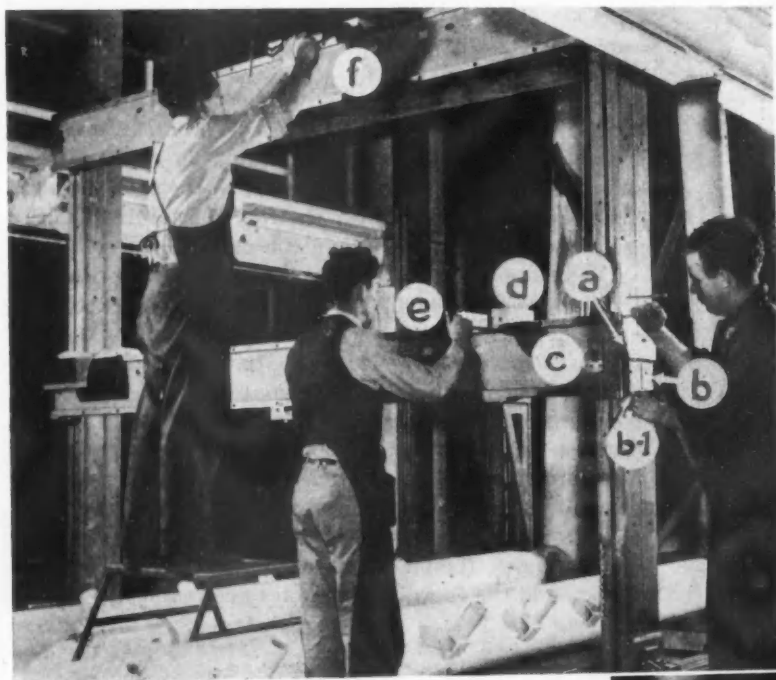


Fig. 4—(Left)—The transverse straight edges are positioned. This operation is accomplished as follows:—Water line strip template (a) is attached to vertical straight edge (b) by means of ground dowel pins (b-1) through jig-bored holes in strip template (a) and vertical straight edge (b). Ground dowel pins are used through margin holes of strip template (a) and transverse straight edge (c) to locate transverse straight edge at first water line. Set-up is clamped tightly by bolting. Index fittings (d) are attached to transverse straight edge (c), locating by butt line strip template (e). Operation is repeated on upper transverse straight edge (f).

in. diameter. For this purpose, the master index drill bar is used at the intersection of the grid lines with the vertical center line of the airplane in the case of a fuselage, or on the wing reference plane in the case of airfoils. Corresponding index holes, drilled in the individual master tooling layouts (loft reproductions) provide a means of coordinating these with the master index template during the stack drilling operations.

Strip templates are used as location gages to establish the positions of points or planes in any of the three dimensions, and they are made of 0.500 in. by 2.0 in. cold-rolled steel. Each is jig-drilled in one margin with a series of 0.500 in. diameter index holes on 10.000 in. centers for coordination with corresponding bushed holes in the straight edges; in the opposite margin are 0.500 in. diameter holes which have been jig-bored at points where airplane stations are located. Ground pins are used in mounting the strip templates on the straight edges.

Since it has a direct bearing on the accuracy of airplane parts, the main requirement for the use of the Master Tooling Dock is that tooling holes be incorporated in the master layout of each part that is to be positioned by a fixture locator during the airplane assembly process. It is further desirable that the master layout be provided with grid lines on 10.000 in. centers.

When the master layout is reproduced in the form of a master tooling layout, it becomes the sole source of reference for the making of the index template and strip template. Therefore, complete coordination of all tooling holes is attained, and it is unnecessary for



Fig. 5—Angle blocks are mounted on transverse straight edge. This operation is accomplished as follows: Angle block (a) is attached by inserting bolt in T-slot of transverse straight edge (b). Enough play is allowed in tightening screw for lateral movement along transverse straight edge. The first two steps are repeated on upper transverse straight edge.

workmen to refer to drawings in order to obtain the required dimensions. All tooling is controlled by the master tooling layouts, which are made and controlled by the template manufacturing section of the tooling department.

The foundation of a Master Tooling Dock would naturally depend on its geographical location. The installation at San Diego has a base which was designed to carry a 350,000-pound load, resist soil movements caused by tide changes, and nullify vibrations

caused by earth tremors and nearby drophammer operations. This foundation is of reinforced concrete, completely independent of surrounding building structure and supported by pilings driven into solid earth.

Embedded in the base are loading rails, which are used to locate the structure of the assembly tool during set-up operations. Bonded to the base are large diameter steel pipes, filled with concrete and reinforcing steel rods, and the columns thus formed support the superstructure of the dock.

The entire dock area (120 ft by 17 ft) is surrounded with an expansion joint of 2.0 in. soft fiber board, asphalt coated, so as to insulate the dock from the building floor.

Thirteen simple steps are normally required to operate the Master Tooling Dock. Their sequence is:

- 1.—The fixture frame is moved into the dock.
- 2.—The fixture frame is positioned in the dock.
- 3.—Ship stations are positioned (Fig. 2).
- 4.—The fixture location is tool proofed.
- 5.—Vertical straight edges are moved to the first station (Fig. 3).
- 6.—The transverse straight edges are positioned (Fig. 4).
- 7.—Angle blocks are mounted to the transverse straight edge (Fig. 5).
- 8.—The index template is mounted (Fig. 6).
- 9.—The index template is reversed for the opposite hand fixture.
- 10.—The former is positioned to the fixture frame (Fig. 7).
- 11.—The former is fastened to the fixture frame (Fig. 8).
- 12.—The former location is tool-proofed.
- 13.—The index template set-up is moved to the next station.

Operations 9, 10, and 11 are repeated at each succeeding ship station until the fixture is completed.

(Turn to page 64, please)

Fig. 6—(Below)—The index template is mounted. This operation is accomplished as follows: Index template (a) is positioned to transverse straight edge (b) by dowel pinning to index fitting (c). Angle block (d) is positioned to line up with tooling holes in the index template (a). Angle block is tightened in position.

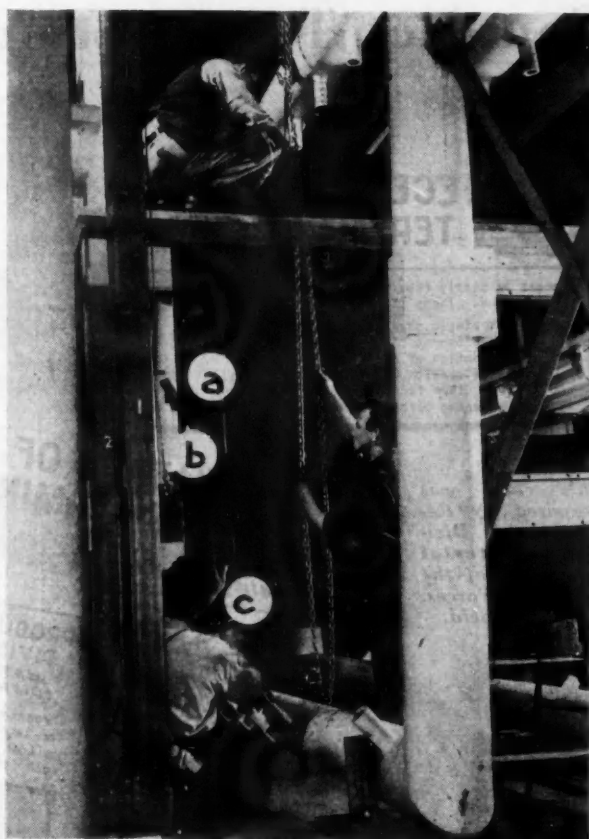
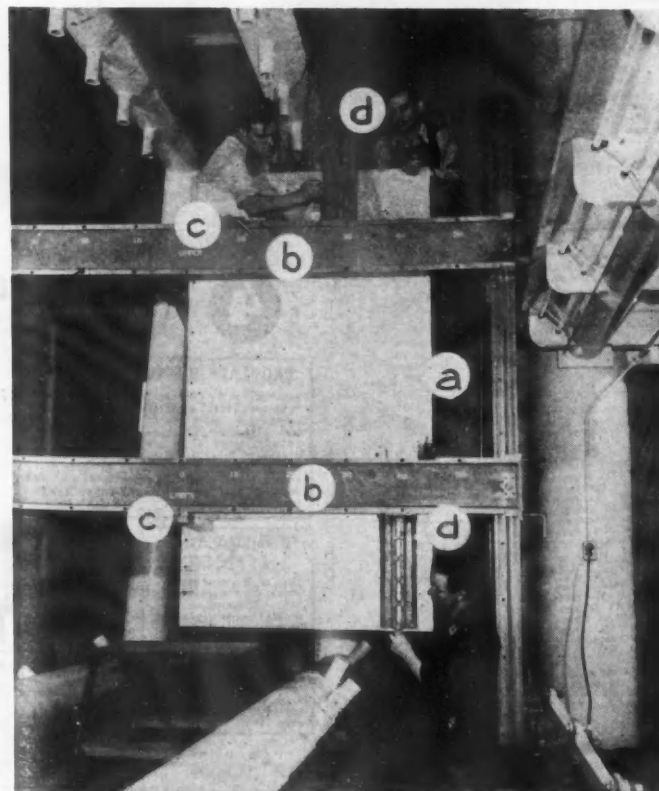


Fig. 7—(Above)—Former is positioned to fixture frame. This operation is accomplished as follows: Tooling holes in former (a) are lined up with those of index template (b). Former (a) is fastened through index template (b) to angle block by means of stripper bolt (c). Set-up is tightened against angle block to established station face.

Fig. 8—(Below)—Former is fastened to fixture frame. This operation is accomplished as follows: Preparations are made to pour Cerromatrix by forming sprue with Babbit-rite. Cap around coupler is sealed with Babbit-rite. Cerromatrix is poured through funnel until the coupler pot is filled. Cerromatrix is allowed to cool and the Babbit-rite is removed.



1 NECESSITY FOR TERMINATION

- a. Strategic changes
- b. Development of new projects
- c. Invention of new items
- d. Reallocation of scarce raw materials and other factors arising under the changing circumstances of modern war

2 INITIATION OF REQUEST FOR TERMINATION



ENGINEERING
DIVISION
MATERIEL
COMMAND

HIGHER
PRIORITY

PRODUCTION
DIVISION
MATERIEL
COMMAND

Screens all requests for termination, as well as originating requests.

WPB

Obtains approval of Production Executive Committee where necessary for termination.

TELETYPE (AARMC Procurement
District in given advance notice of termination
in order that it may plan its course of action)

ST

TERMINATION AUTHORITY

TO: Chief, Readjustment Div.
Bright Field, Dayton, O.
ATTN: Termination Section
SUBJECT: Contract No. _____ Item _____
Company _____

Initiator _____
Telephone _____
(Unit Ref. _____)
Date _____
J.C.P.F. _____
Fixed Price _____
P.O. _____

1. The following recommendations have been con-
sidered and approved by _____
2. It is requested that action be taken to ter-
minate the subject contract. _____
3. _____
a. _____
b. _____
c. _____
d. _____
e. _____
f. _____
g. _____
h. _____
i. _____
j. _____
k. _____
l. _____
m. _____
n. _____
o. _____
p. _____
q. _____
r. _____
s. _____
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READJUSTMENT
DIVISION
TERMINATION
SECTION

3 ISSUANCE OF NOTICE OF TERMINATION

- a. Proper cutback point
- b. Status of GFE
- c. Inventory and lifetime spares position
- d. Effect on labor utilization
- e. Comparative efficiency of various contractors

ERED IN TERMINATION

- f. Maximum utilization of small business
- g. Conservation of more than one source of supply
- h. Preservation of more than one Gov't-owned, DPC etc.
- i. Type of facility expansion i.e. a normal product of contractor

Whether item being produced is a normal product of contractor

4 TERMINATION CO

EMERGENCY
TELEGRAM
OFFICIAL BUSINESS-
GOVERNMENT RATES

From: WAR DEPARTMENT
 AAF MATERIAL COMMAND
 Bureau MILITARY FIELD
 LIAISON, OHIO

E. W. RAMSDORF
 COLONEL, AIR CORPS
 CHIEF, READJUSTMENT DIVISION

DISTRICT SUPERVISOR
 PROCUREMENT DISTRICT
 ATTENTION: TERMINATION SECTION

RE: - - - - -

EFFECTIVE IMMEDIATELY THE GOVERNMENT HERewith TERMINATES FOR CONVENIENCE CONTRACT NO. _____

YOU ARE DIRECTED TO DISCONTINUE ALL WORK AND MARKING OF ALL SUBCONTRACTORS AND SUPPLIERS. YOU TO LIKEWISE.

ALL SUBCONTRACTORS AND SUPPLIERS TO ITEMS PREVIOUSLY ON THIS NOTICE IS NOT APPLICABLE TO ITEMS HEREIN SHIPPED. NO SHIPMENTS MADE ARE TO BE MADE AFTER THIS NOTICE. YOU ARE AUTHORIZED TO DIVERT TO OTHER WORK PRODUCTION ANY EXCESS MATERIALS, EQUIPMENT OR SUPPLIES FOR SALE, AND TO AUTHORIZE ANY SUBCONTRACTORS TO TERMINATE. YOU ARE REQUESTED TO NOTIFY THE WORKERS SIMILARLY. YOU ARE REQUESTED TO INFORM WORKERS AFFECTED AND THEIR UNION REPRESENTATIVES OF THIS TERMINATION AND THE REASON THEREFOR. IF YOU ARE ASKED TO BE HELD ON FOR THE TERMINATION, YOU ARE REQUESTED TO COOPERATE WITH THE MHC IN DETERMINING THE WORKERS TO BE RELEASED. IF ANY RELEASED SHOULD BE EMPLOYED, WORKERS AFFECTED AND OF THE ASSISTANT SUPERVISOR. YOU ARE REQUESTED TO NOTIFY YOUR SUPERVISOR, FURTHER, YOU ARE REQUESTED TO NOTIFY YOUR SUBCONTRACTORS AND SUPPLIERS OF THE REASON FOR THIS TERMINATION AND FURNISH THEM WITH THE NAME OF SUBCONTRACTORS AND SUPPLIERS THAT MAY BE SUBSTANTIALLY AFFECTED BY THIS TERMINATION. THE REASON FOR THE TERMINATION IS:

REQUEST YOU CONTACT DISTRICT SUPERVISOR, _____

ATTENTION: TERMINATION SECTION, FOR ANY INFORMATION IN CONNECTION HEREWITH. MILITARY FIELD DOCKET NO. _____

LETTER AND INSTRUCTIONS FOLLOWING. ADVISE AGENCY CONTRACTING OFFICER

PREPAID
 Distribution **

7790
Fixed Price

ARMY AIR FORCE
Historical Collection

In reply please refer to:
Docmat No.

Subject: Request for Termination
and Request for a Negotiated
Settlement Contract No.

Class

To:

1. The necessity and convenience of the Government require that your Contract No. be terminated, such termination to be effective at 11:00 o'clock P.M. on 194, and that steps be taken immediately to agree with you upon a settlement, if any is necessary, which will properly and justly compensate you in accordance with the provisions of said contract for the uncompensated portion thereof. Accordingly, pursuant to the provisions of of that contract, and in conformity with the provisions of the Contracting Officer, dated effective at 11:00 o'clock P.M. on 194.

2. You are hereby instructed immediately (1) to stop all work and the placing of any subcontract or orders in connection with that contract; and (2) to terminate all execution thereof and orders and to cause all work in connection therewith to be stopped at once. A form of instruction for use to subcontractors, marked Exhibit 1, is included on notice in this connection. To the instructions in and (2), there are the following exceptions:

You are also instructed to take the following action in respect to Government property now in your custody:

(continued).

PROPERTY DISPOSAL OFFICER

instruction to contractor on preparation of inventory lists; arrangement for segregation, counting & inspection of inventories; plans for contractor retention of property & return to suppliers; procedures for "On the Spot Disposal"; deadline dates for submission of partial and total inventory; estimate of amounts & disposition of property to be taken over by Government; procedures re subcontractor property.

**CONTRACTING
OFFICER**

(and/or his representative, the negotiator)
Chairman
General supervision of conference; explanation of "General Instructions for use of Contractor's Proposal Forms"; inter financing; policy re subcontractors' claims; advice on composition of contractors' termination department.

AAF INSPECTOR

Physical inspection of quality & quantity of termination inventory; preparation of necessary certificates; arrangement for physical & chemical analyses, if necessary.

Procedure in AAF Materiel Command

5 PREPARATION OF CONTRACTOR'S CLAIM

Form No. A-1 CONTRACTOR'S SETTLEMENT PROPOSAL SUMMARY STATEMENT

The CONTRACTOR'S SETTLEMENT PROPOSAL (Summary Statement) Form No. A-1 is the end item on which the final negotiated settlement will be arrived:

Form No. B-1 CONTRACTOR'S OWN CHARGES SCHEDULE

CONTRACTOR'S OWN CHARGES TO DATE OF TERMINATION APPLICABLE TO TERMINATED PORTION OF CONTRACT

Form No. C-1

Applies to inventories of raw materials, purchased parts & supplies applicable to the contract. It also covers end items completed.

Form No. C-2

Applies to work in process inventories—costs applicable to the property listed may be computed on one of two bases: (a) the inventory method or, (b) the total cost method.

Form No. C-3

Applies to Jigs, Tools, Dies, Fixtures, etc.

INVENTORY is obviously a basic element in the contractor's claims

To present a detailed breakdown of the inventory for which payment is requested, the Contractor uses 3 forms:

FORM NO. C-1

Applies to inventories of raw materials, purchased parts & supplies applicable to the contract. It also covers end items completed.

FORM NO. C-2

Applies to work in process inventories—costs applicable to the property listed may be computed on one of two bases: (a) the inventory method or, (b) the total cost method.

Inventory Method—Costs applicable to the uncompleted portion of the contract are determined by pricing the inventory in detail. (The profit is then added).

Total Cost Method—Costs incurred on entire contract to date of termination are summarized and profit allowance applicable thereto is added; deduction is then made of payments made or to be made by the Government for completed units.

FORM NO. C-3

Applies to Jigs, Tools, Dies, Fixtures, etc.

6 PROPERTY DISPOSAL

Contractors & Contracting Officers will be guided by the GENERAL POLICY that, without delaying the final settlement, idle & excess termination inventory items should be disposed of promptly after the termination so that delivery of property or passing of title to the Government will be unnecessary.

After the first termination meeting, the Property Disposal Officer and the Contractor's disposal organization begin an immediate SEGREGATION, COUNTING & INSPECTION of property included in the termination inventory.

INDUSTRIAL PROPERTY IS CLASSIFIED AS

SERVICEABLE

- C-1 RAW MATERIALS, PURCHASED PARTS, ETC.
- C-2 WORK IN PROCESS
- C-3 JIGS, TOOLS, DIES, FIXTURES, ETC.

5 copies of inventory lists C-1, C-2 and C-3 are forwarded to the District Readjustment Division for review and necessary action.

The C-1 and Supplementary Forms listing property included in Exhibit A of the Memorandum of Understanding with Metals Reserve Company (Steel, Copper, Aluminum, Specified Items of Hardware and Components) will be forwarded to the Property Disposal Section, Readjustment Division, Wright Field.

Property so forwarded will not be sold, shipped or transferred without prior approval of Metals Reserve Company.

Upon receipt of such lists by the READJUSTMENT DIVISION...

NON-REPAIRABLE

CLASSIFIED AS

- CURRENT PRODUCTION SCRAP
 - OBsolete PROPERTY Including new items peculiar to aircraft but of no use to AAF
 - UNSALEABLE PROPERTY Including such items as obsolete work-in-process
 - DAMAGED PROPERTY
- Determined to have no use by AAF and for which there is no market
- disposed of in the following manner and with the appropriate warranties

SALES AT OR BELOW SCRAP CEILING

WARRANTY

The purchaser warrants that the property covered by this agreement was offered as scrap, purchased by him as scrap, and that he will sell and ship, or use it as scrap in its existing condition or after further preparation only in conformity with existing regulations.

PURCHASER

SALES ABOVE SCRAP CEILING

WARRANTY

The Purchaser agrees that he will use or consume the property covered by this contract in the United States for manufacturing, construction, maintenance or repair purposes and that, if he does not so use or consume it, he will not resell such property at a profit; however, if he repairs, reworks, strips or disassembles any of the property or materials or components contained therein, he may resell these items, and any scrap resulting from such repair, rework, stripping or disassembling, at a profit.

PURCHASER

This inventory is tabulated, and saleable items therefrom are released to Metals Reserve Co., an R.F.C. agency for sale through trade channels.

Continued on next page

7

ON THE SPOT DISPOSAL

From the outset, emphasis is placed on "On the Spot" disposal of termination inventory. Initial attention will be given to the desirability of retention by the contractor of such property as he desires or the diversion of such property to manufacturers of similar end items. Efforts will be made to have supplies returned to sub-contractors & vendors where possible. SALES transactions by which this program of speedy disposal will be prosecuted will be of two types:

1. DIRECT SALES

Sales of government property directly to a purchaser; approval of such sales should be obtained from the Contracting Officer.

2. CONTRACTOR SALES

Sales by a contractor (or sub-contractor) of property, title to which is in the Government or to which the Government has a right to acquire title and the disposition thereof requires the approval of a Contracting Officer.

Contractor Sales may be:

- Fixed Price Sales- Sales by CMF contractors of Gov't. property under articles written into the original purchase contract as authorized by Procurement Regulation No. 363; approval is the sole responsibility of the Contracting Officer.
- Fixed Price Contractor's Sale of Contractor-owned Property under a Standard Form of Termination Article or Supplemental Agreement. - The AAF is concerned with these sales because, under provisions of the termination article, the Government has a right to acquire title to the proceeds of such disposition. - These sales must also be approved by Contracting Officer.

**A Principle to remember in arranging sales is ...
THE GREATEST DEGREE OF COMPETITION
CONSISTENT WITH SPEED AND ECONOMY**

- ▶ Property will be sold for use in the war effort whenever possible.
- ▶ Property will (generally) be sold in existing condition due to lack of repair facilities.
- ▶ Sales at ceiling or market prices should not be delayed for solicitation of bids.
- ▶ Bids at market price less handling charges, normal jobber's discount etc., should ordinarily be satisfactory without resort to competitive bidding.

The nearest available Area or Plant Disposal Board will be consulted:

- When the proposed sales price is \$1,000,000 or more.
- When a particular sales transaction involves property costing over \$100,000 which is proposed to be sold below cost, less freight and handling charges.
- When a particular transaction involves property costing over \$10,000 which is proposed to be sold at 25% or more below cost.

THE POLICY OF THE WAR DEPARTMENT IS, THAT ON DEMAND OF THE CONTRACTOR, ALL UNDISPOSED OF PROPERTY SHALL BE REMOVED FROM CONTRACTORS & SUB-CONTRACTORS PLANTS WITHIN 60 DAYS AFTER RECEIPT OF ACCEPTABLE INVENTORY LIST. THIS WILL BE ARRANGED BY THE PEO (Through the District Organization) BY MEANS OF STORAGE LOCALLY (Through a Service Contract) OR BY NOTIFYING AAFPC P.O.O. OF THE PROPERTY WHICH MUST BE REMOVED AND REQUESTING SHIPPING INSTRUCTIONS THEREON.

Continued from
previous page

8

ACCOUNTING REVIEW

(Conducted by Contract Audit Branch, Budget & Fiscal Office, Hq., AAF)
"Delay in approving contractor's statements of charges results not only from improper preparation of statements but also from the unreasonable dilatory of detailed auditing." - Under Secretary of War, PR 15-422.

Government accounting and auditing personnel conduct such investigations, reviews and audits as are necessary to determine whether the settlement proposal is in accordance with termination provisions and is substantiated by necessary supporting records.

ACCOUNTING REVIEWS ARE OF THE FOLLOWING TYPES:

1. OFFICE REVIEW

to be made in all cases - an overall check to determine reasonableness of claims, propriety of manner of preparation and mathematical accuracy. (as set forth in Termination Accounting Manual par. 7 et seq.)

2. SPECIFIC DETAILED AUDITS

the desirability of which may become apparent from the initial office review. The contracting officer will make the decision as to whether such examinations and audits will be made; he will be guided as to the necessary procedures therein by his technical and accounting personnel.

The Termination Accounting Manual sets forth the detailed procedures to be followed in accounting reviews.

Contractor's accounting personnel will make reviews, similar to above, of sub-contractor's claims.

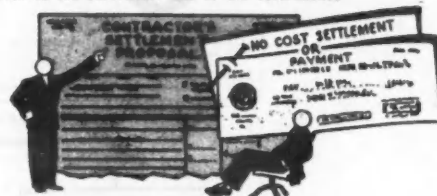
The accounting review is a continuing procedure; such reviews will, in many cases, be of value in validating & expediting partial payments to contractor; arrangements as to the proper accounting practices to be followed should be agreed upon at the time of the first conference with the contractor.

The general procedures above apply to settlements made on the negotiated basis and not to the negotiated settlements which may be arrived at by application of a formula.

9

NEGOTIATED SETTLEMENT

The negotiated settlement is just what its name implies -- an agreement between the contracting officer and the contractor whereby the contractor's termination claim is promptly settled on a basis which is fair and equitable both to the contractor and to the Government.



The contractor receives the contract price for completed articles.

In respect to the uncompleted portion of the contract, the contractor receives "Such sum as the contracting officer and the contractor may agree by supplemental agreement is reasonably necessary to compensate the contractor for his costs, expenditures, liabilities, commitments and work in respect to the uncompleted portion of the contract."

"The contracting officer shall include in such negotiated sum, such allowance, if any, for profit with respect to work already done on the uncompleted portion of the contract as he deems reasonable under all the circumstances."

"The contracting officer is not tied down to any particular method of computing this profit allowance."

The contracting officer should agree only to such allowance for profit as is fair in the light of (a) work actually done by the contractor and (b) materials actually obtained or furnished; it is not intended that the contractor shall be allowed any profit with respect to work which has not been done.

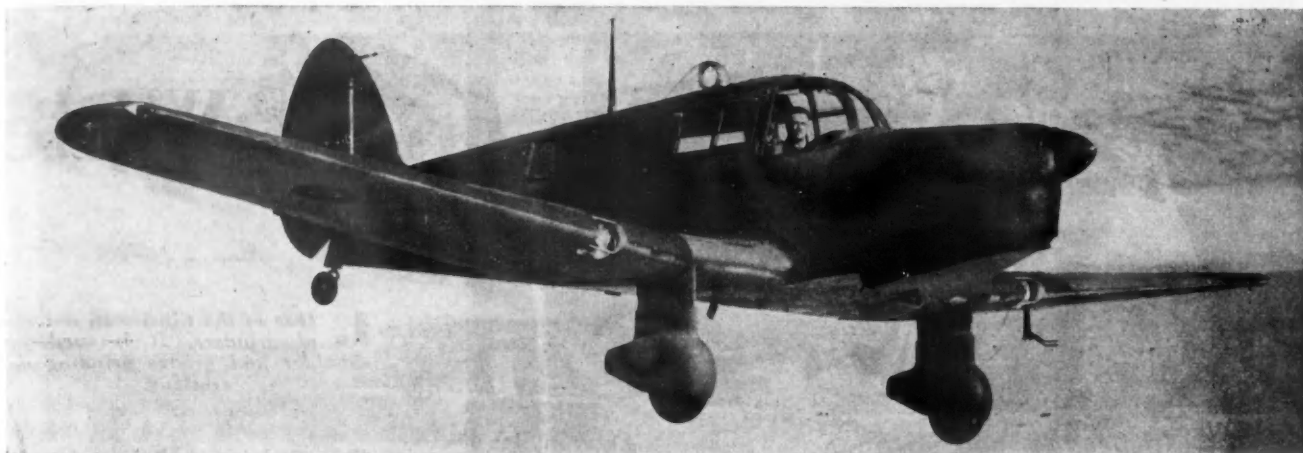
| SCHEDULE A-1-B - POST TERMINATION CHARGES | | | |
|--|-------------|--------|------------------------|
| Item | Explanation | Amount | Do not use this column |
| Provision is made in the Summary Statement (Schedule A-1-b thereof) for the contractor's being reimbursed for amounts properly expended subsequent to the date of termination for the protection of government property including shipping, packing, drayage, inspection and other expenditures and costs as may be necessary to settlement of the contract. | | | |

APPROVAL & REVIEW

1. Each proposed settlement involving a payment of more than \$10,000 will be submitted to a District Settlement Advisory Section, which section will review the terms of the settlement and express approval or disapproval in writing. If the Contracting Officer does not accept the advice of the Section, he should:

- preserve a written memorandum of reasons for not doing so, or
- appeal to AAFPC Settlement Review Board for decision which shall be binding.

2. All proposed settlements involving over \$500,000 shall be forwarded with recommendations by the District Section to the AAFPC Review Board. Approval of the Board is required before signature of the settlement proposal by the Contracting Officer. (see FOM 131, sec. 3)



The Proctor IV trainer. The fairing of the undercarriage is said to have added 15 mph to the maximum speed

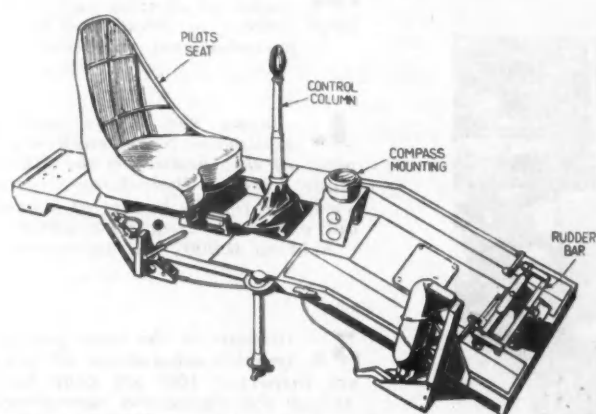
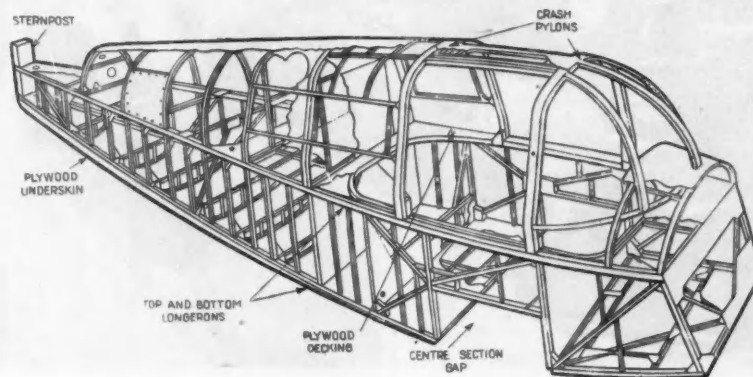


Fig. 1—Flying control unit of Proctor trainer. Built as a separate assembly, it is bolted in place and easily removable. A duplicate can be fitted alongside, without structural alterations to the fuselage, when dual control is required for instructional purposes. Control runs from the tail unit and wing surfaces are coupled up below the rear end of the platform. (Courtesy Aircraft Production, London)

THE British Air Ministry has released details concerning the new airplane known as the Percival Proctor IV, which is powered by a de Havilland Gipsy Queen II engine, an inverted six-cylinder in-line air-cooled type of 210 hp. It is notable in being the first all-wood aircraft to go into production in England in which synthetic resin cement is used throughout the structure. Plastics are used not only for bonding the plywood and laminated components, but also for main structural joints and as a protective surface finish. The Proctor IV was designed as a radio training plane for the British Royal Air Force and the Fleet Air Arm. Another version is intended for communications use, the interior cabin arrangement providing two rows of seats

Fig. 2—Framing of Proctor fuselage. (Courtesy Aircraft Production, London)



British Proctor IV Trainer Built Chiefly of

Wood and Plastics

By M. W. Bourdon

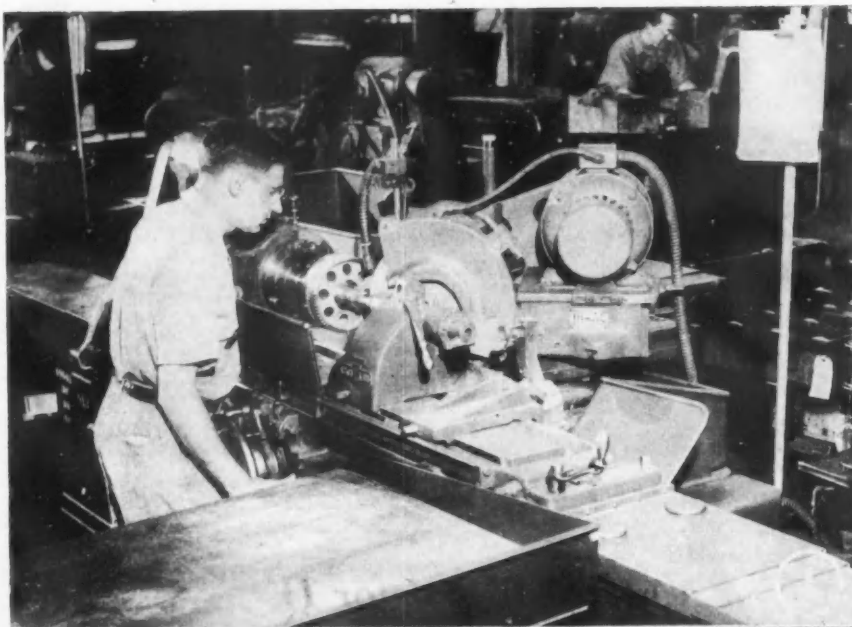
Special Correspondent of
AUTOMOTIVE AND AVIATION INDUSTRIES in Great Britain

for four persons, which of course includes the pilot.

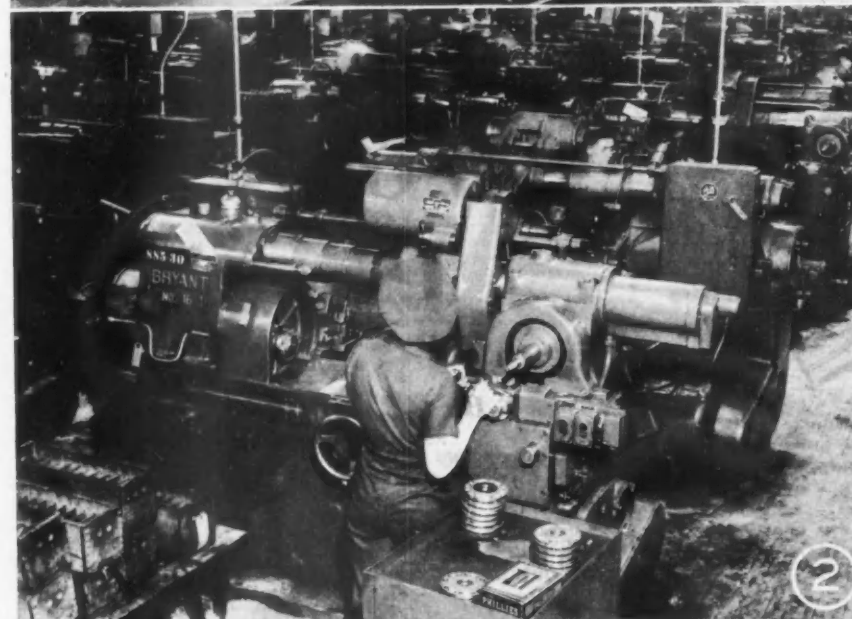
One outstanding constructional feature is the "flying control unit" (Fig. 1) consisting of a platform on which are mounted the pilot's seat, control column, rudder bar, compass and other associated equipment, assembled as a separate and readily removable unit in the cabin, bolted down to the spars of the center section of the wing. As a result of this arrangement, the machine can be converted readily to one having

(Turn to page 62, please)

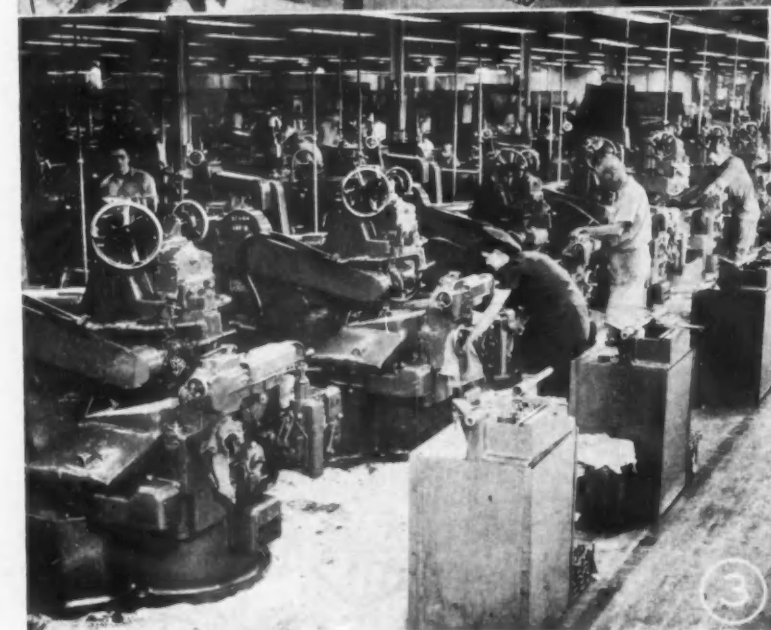
Wide



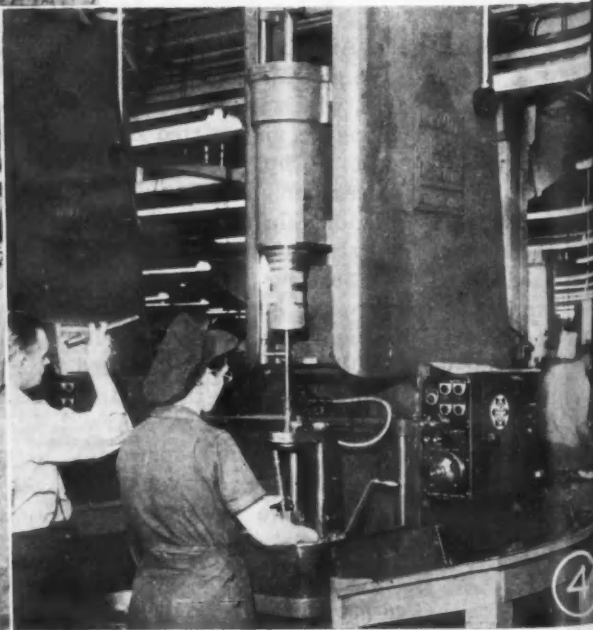
1. One of the Cincinnati universal grinders. It is used for shoulder and groove grinding operations.



2. Battery of Bryant internal grinders for precision bore grinding and face grinding.



3. View in the gear grinding department showing part of the large battery of Pratt & Whitney precision gear grinders.



4. Among the most modern equipment to be found in any plant of the industry is the Micro-matic Vertical Hydrohoner. It is used here for the honing of a small but extremely long bore which is held to 0.0007 in. tolerance.

5. Glimpse of the main gear inspection laboratory. All gears are inspected 100 per cent here. Among the equipment represented in the group are—Illinois involute checkers; Brown & Sharpe machine for eccentricity; Illinois lead checkers; Fellows Red Liner for interference checking; Magnaflux Method machine for surface perfection.

By Joseph Geschelin

Variety of Gears

Wide Variety of Gears Flow from Foote Bros. Plants; Aircraft Actuators Also Produced

SPECIALIZATION for over 50 years in the manufacture of gears and speed reducers has established the Foote Bros. Gear & Machine Corp. as an outstanding producer in its chosen field. The Industrial Gear Division makes a wide variety of unmounted gears and gear sets, ranging from a tiny gear to enormous ones up to 20 feet in diameter. It is also noted for its line of reduction gears which ranges from the smallest to the largest sizes required by industry.

From the beginning and even today, the output of the Industrial Gear Division has been characterized by endless variety, produced in single units or in small lots. Accordingly, the entire operation is based upon flexibility—in design, in production management, in equipment and tooling. Generally speaking, the equipment used in this division is of universal type capable of quick changeover from one set-up to another. Needless to say, this type of operation relies to a large extent upon the individual skills of the workers, many of whom have grown with the job over a long period of time.

*This is the Ninety-seventh
in the series of monthly
production features*

Early in 1939, the company was called upon to participate in the manufacture of gears for Pratt & Whitney radial aircooled aircraft engines. Thus the know-how of a half-century of gear making was turned to placing the manufacture of intricate precision gearing and shafting on a mass production basis. How well this was done may be gaged by the fact that in 1943, the Precision Gear Division delivered more than a million of these gears to Pratt & Whitney plants.

More recently, the company embarked upon the manufacture of aircraft actuators—compact self-contained power packages. These have a wide range of application in military aircraft, taking over a variety of tasks formerly performed manually. Among these uses are the following—for inter-cooler flaps, for oil cooler flaps, for accessory drive transmissions, for dive flaps, for screw jacks. The experience thus gained should make possible the extension of the use of actuator power packages for peacetime applications for industrial machinery and on automotive equipment.

So far as aircraft gear production is concerned, it may be noted that the cooperative venture has made it possible for Foote Bros. to contribute detail design changes tending to improve the product; and to develop many ingenious techniques and methods of metal removal in the interest of improvement in quality and reduction in cost.

To provide a better visualization of the scope of activity of this versatile organization, consider briefly the range of products. In the production of gears they cover the gamut of materials—non-ferrous, steel, cast iron, Bakelite, and bronze. By gear types they cover—spur, helical, worm, bevel, and the gamut of aircraft gears, shafts, and splines, and com-



Factory Routing—Reduction Gear Drive

| OPERATION | EQUIPMENT | OPERATION | EQUIPMENT |
|---|--------------------------------------|---|---------------------------------|
| Normalize, quench in oil | Lindberg hydrazing furnace | Check flat & round straighten if necessary | General power press |
| Draw | Lindberg draw furnace | Chuck on pitch diameter, grind bore & external face | Heald internal grinder |
| Sandblast all over | Pangborn Rotoblast | Finish grind both faces per sketch | Hanchett rotary surface grinder |
| Finish turn OD face and counterbore, chamfer a small portion ID | Potter & Johnston turret lathe | Finish grind OD | Norton "C" external grinder |
| Finish turn other side, internal groove & bore | Potter & Johnston turret lathe | Finish grind both internal faces per sketch | Heald internal grinder |
| Broach internal spline | Colonial broach | Finish grind internal groove | Heald internal grinder |
| Hob external teeth (4 at a time) | Barber-Colman hobbing machine | Finish grind 1/32 in. radius in groove | Heald internal grinder |
| Burr external teeth | DuMore grinders | Grind 16 in. radius on OD, both sides | Heald internal grinder |
| Burr internal spline per sketch | DuMore grinders | Grind chamfer on both sides internal teeth | Heald internal grinder |
| Wash | | Finish grind steps on both sides | Heald rotary surface grinder |
| Visual & dimensional inspection | | Draw | Lindberg draw furnace |
| Inspect before carburizing | | Grind internal spline | Geargrind internal grinder |
| Degrease | Detrex degreaser | Grind teeth | Pratt & Whitney gear grinder |
| Carburize and slow cool | Leeds & Northrup carburizing furnace | Magnaflux & inspect teeth & concen. | |
| | Homocarb | Handi-grind external teeth & internal spline | DuMore grinders |
| | Pangborn rotary shot-blast | Final polish per sketch | L'Hommedieu polishing lathe |
| Sandblast all over lightly | | Wash | |
| Chuck flat, round, straighten if necessary | General power press | Surface inspect | |
| Finish turn web both sides | Warner & Swasey Turret lathe | Magnaflux & demagnetize | |
| Finish polish web, both sides and remove all tool marks | L'Hommedieu polishing lathe | Final inspect | |
| Wash | | Final etch part number, etc. per sketch | Ideal etching machine |
| Visual & dimensional inspection | | Remove etch from OD of 1 tooth | Miscellaneous bench work |
| Inspect before hardening | | Wash & degrease | |
| Degrease | Detrex degreaser | Oil, wrap & ship | |
| Harden and quench | Westinghouse hardening furnace | | |
| Degrease | Detrex degreaser | | |
| Draw 3½ hours, cool in air | Lindberg draw furnace | | |
| Electro clean | Udylite plating machine | | |
| Draw at 350 deg. for 1 hour | Lindberg draw furnace | | |
| Inspect for hardness | | | |

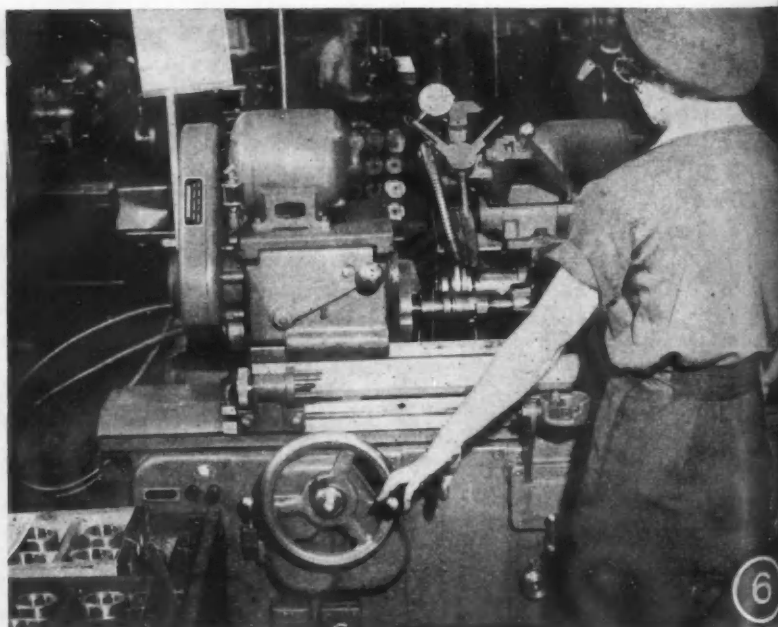
binations of these. As to finish, they make to specification—ground tooth, lapped tooth, shaved, etc.

Speed reducers, the staple product, are made in the following types—spur, helical, worm, planetary, right angle drive. These are produced in a full range of sizes from tiny units to large industrial units in single, double, or triple styles. In addition, the Industrial Gear Division makes speed reducer bases, shaft couplings, flexible couplings.

Considering the established reputation for quality of its peacetime products and the exceptional levels of dimensional tolerances and fine finish required for the aircraft gearing, it is only natural to find an impressive setup for quality control. The casual observer is bound to be impressed with the large array of inspection benches for final acceptance. But it should be noted that quality control extends to every step in the process, starting with self-checking by the individual machine operators who are provided with the necessary gages and instruments for their specific operations.

Quality control is further assured by the policing activity of a gear laboratory in each plant; and by a comprehensive metallurgical laboratory, comprising equipment and instrumentation for chemi-

cal and physical testing of materials. Surface perfection is achieved through the application of the Magnaflux method of detecting surface flaws; and through the use of the Brush Surface Analyzer for measurements of fine finishes in micro-inches.



10. This huge Conomatic is a bar machine producing the many items turned from bar stock.

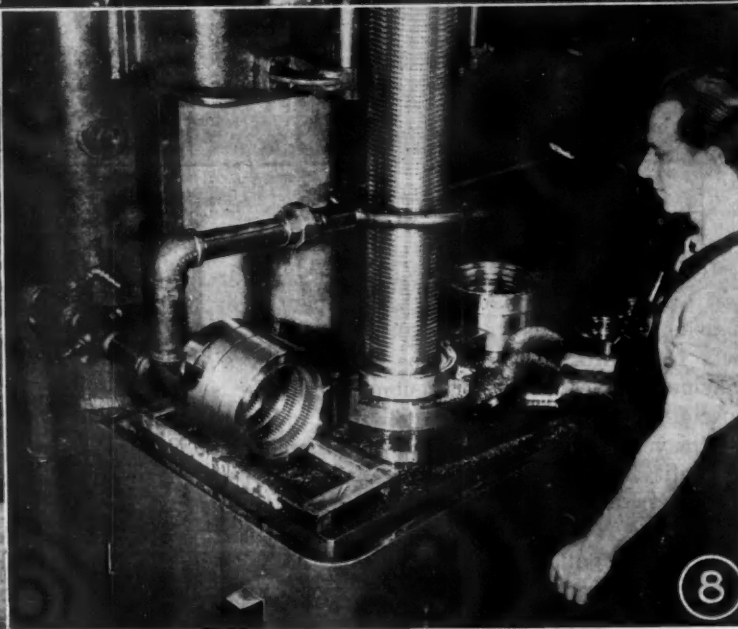
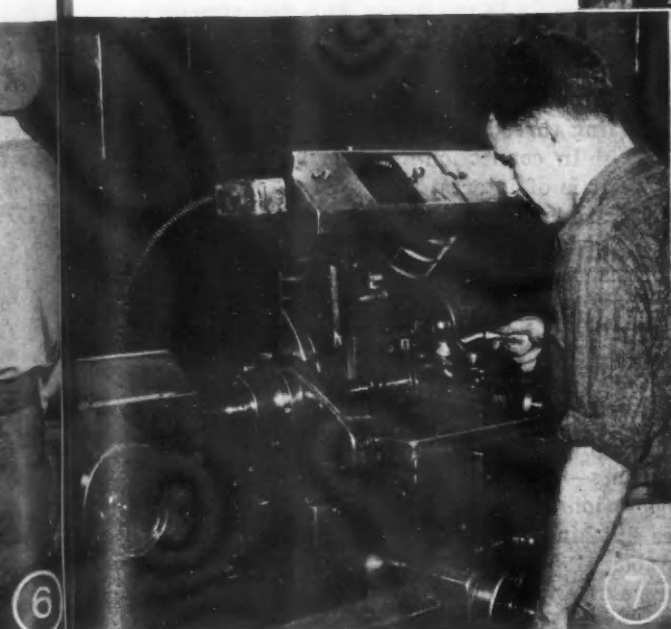
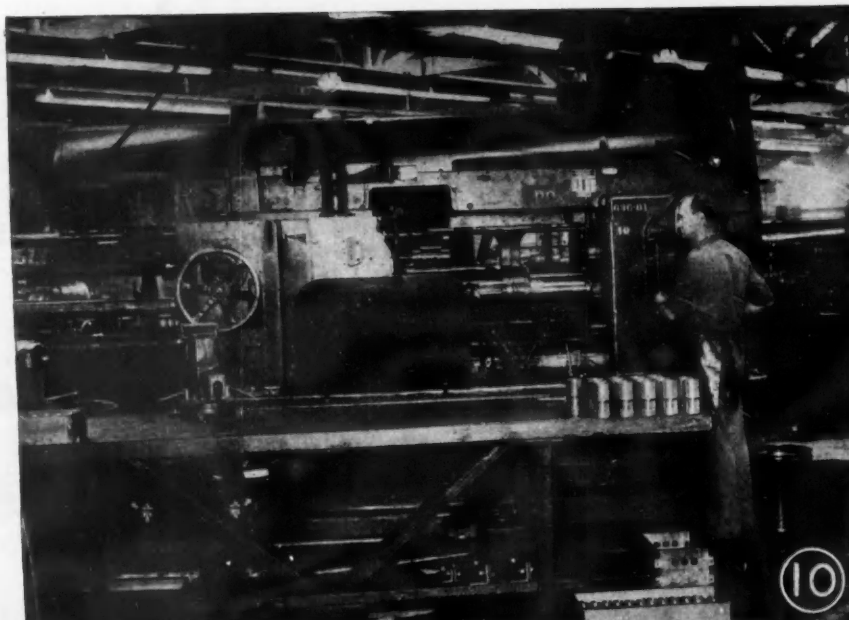
9. Here is one of the batteries of Fellows gear shapers found in various departments of the plant. In the foreground are the larger machines specializing in the cutting of internal-external ring gears.

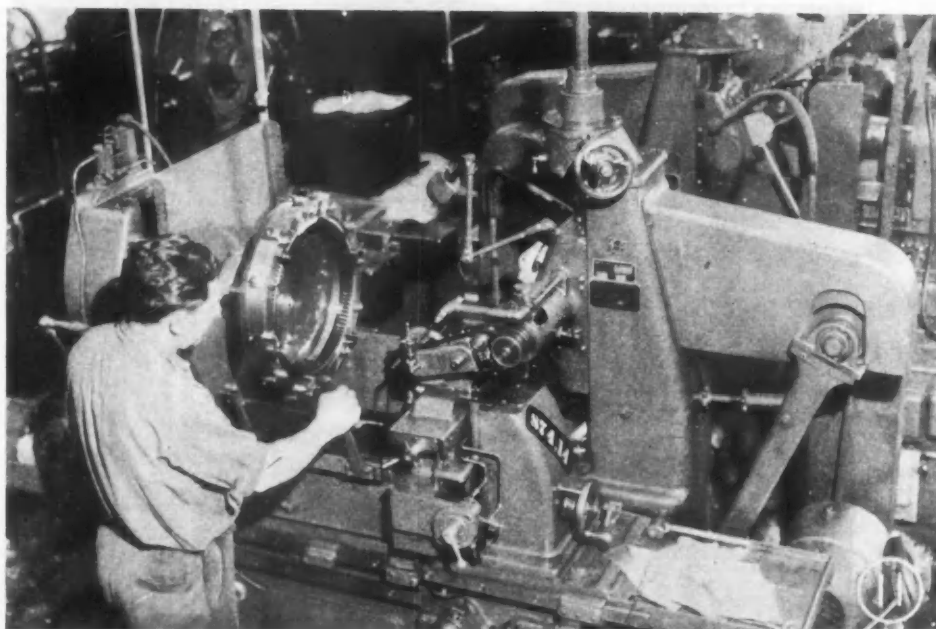
8. One of a number of Colonial vertical broaching machines in this plant, this is a large heavy duty broach used for form-broaching a 76-tooth internal spline. Formerly this operation was performed by shaping.

7. Close-up of Ex-Cell-O No. 31-L precision thread grinder adapted for the grinding of small precision type worms.

6. Among the many Norton grinders in this plant, this machine handles the finishing of oil seal ring grooves.

Some impression of the character of precision demanded of the aircraft product may be gained from the following examples. On ground teeth, the involute profile is held accurate to within 0.0002 in.; tooth spacing to 0.0004 in.; and maximum run-out of pitch circle to 0.002 in. (Next page, please)





11. In the gear grinding department is a parallel row of the familiar GearGrind precision gear and spline grinders. In the foreground is a GearGrind specializing in the grinding of internal gears.



12. Example of a Barber-Colman vertical gear hobber which is used for precision hobbing of external gear teeth. It is claimed that the productivity of this machine is $3\frac{1}{2}$ times that of a conventional hobber.

V-T-L's, etc., of the kind usually found in tool and die shops. This type of machinery is employed in the finishing of gear boxes, turning of gears

and shafts. Hobbing machines such as Barber-Colman, Gould & Eberhards, and Newarks are employed for cutting gears and splines. A large Gleason generator department serves to handle all of bevel gear production. Gear and shaft blanks are machined in a separate department equipped with turret lathes and engine lathes, with LeBlond heavy duty lathes predominating.

Influence of the war program is sensed in the new departments for handling the high production precision worm gear sets for special speed reducers. Here will be found a battery of the latest type Fellows gear shapers, Fellows gear shaver for shaving gears, and a Red Ring lapping machine for lapping the gears after shaving. The familiar Red Ring gear speeder is used for running-in the gears. This department, too, boasts a number of Ex-Cell-O precision thread grinders. One of these is set up for producing ground worms, the others grinding threads from solid metal.

In connection with reduction gear sets, it is of interest to learn that mating gears are lapped and run-in while installed in the gear-box, thus assuring complete compati-

bility of mating parts on their own gear-box centers. This process is more expensive, takes longer, but results in quiet and smooth running gearing with consequent assurance of long life.

PRECISION GEAR DIVISION—This is the wartime activity producing gears for Pratt & Whitney aircraft engines. It is composed essentially of three major plants—two self-contained plants for preparatory operations, both feeding the main plant which handles finishing operations exclusively. This group makes about 100 different gears and shafts, specializes in spur gears and splines exclusively.

(Turn to page 87, please)

INDUSTRIAL GEAR DIVISION—This is housed in its original surroundings, supplemented by an expansion during the war to take care of special products for military use such as gearing for a line of marine engines, small precision worm gear sets for special reducers, and the like, required in large volume. By the very nature of the business, this plant has been, in reality, a glorified job-shop capable of producing a steady stream of an endless variety of product in small quantities. Flexibility has been its stock in trade.

The main gallery of the plant bristles with an impressive array of fine universal types of machinery such as boring mills, planers, milling machines, Bullard

Lend-Lease Exports

March, 1941, to
May 31, 1944

Millions of Dollars

| | United Kingdom | U. S. S. R. | Africa, Middle East and Mediterranean Area | China, India, Australia and New Zealand | Other Countries | Total |
|--|----------------|--------------|--|---|-----------------|----------------|
| MUNITIONS | | | | | | |
| Ordnance | \$ 437 | \$ 277 | \$ 271 | \$ 152 | \$ 77 | \$1,214 |
| Ammunition | 923 | 431 | 344 | 208 | 68 | 1,974 |
| Aircraft and Parts | 1,404 | 1,124 | 660 | 565 | 369 | 4,122 |
| Tanks and Parts | 722 | 314 | 519 | 153 | 43 | 1,751 |
| Motor Vehicles and Parts | 450 | 776 | 385 | 337 | 64 | 2,012 |
| Watercraft | 203 | 142 | 41 | 33 | 22 | 441 |
| Total | 4,139 | 3,064 | 2,220 | 1,448 | 643 | 11,514 |
| INDUSTRIAL MATERIALS AND PRODUCTS | | | | | | |
| Machinery | 442 | 611 | 128 | 182 | 28 | 1,391 |
| Metals | 651 | 564 | 166 | 218 | 26 | 1,625 |
| Petroleum Products | 661 | 38 | 63 | 149 | 8 | 919 |
| Other | 409 | 384 | 215 | 168 | 32 | 1,208 |
| Total | 2,163 | 1,597 | 572 | 717 | 94 | 5,143 |
| AGRICULTURAL PRODUCTS | | | | | | |
| Foodstuffs | 2,065 | 885 | 174 | 87 | 22 | 3,233 |
| Other Agricultural Products | 482 | 105 | 15 | 31 | 2 | 635 |
| Total | 2,547 | 990 | 189 | 118 | 24 | 3,868 |
| TOTAL EXPORTS | 8,849 | 5,651 | 2,981 | 2,283 | 761 | 20,525* |

Percentage Distribution

by Destination
and One-Year Periods

| | Munitions | Industrial Materials and Products | Agricultural Products | Total Exports |
|--|--------------|-----------------------------------|-----------------------|---------------|
| United Kingdom | 35.9% | 42.0% | 65.9% | 43.1% |
| U. S. S. R. | 26.6 | 31.1 | 25.6 | 27.6 |
| Africa, Middle East and Mediterranean Area | 19.3 | 11.1 | 4.9 | 14.5 |
| China, India, Australia, New Zealand | 12.6 | 14.0 | 3.0 | 11.1 |
| Other Countries | 5.6 | 1.8 | .6 | 3.7 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |

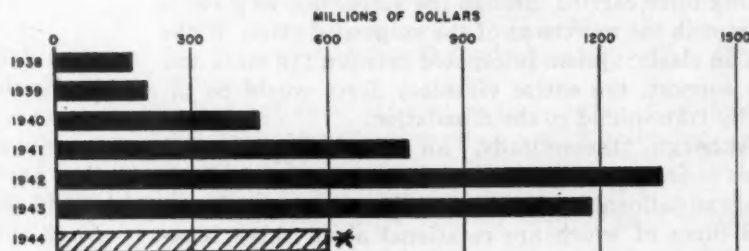
by Destination
March, 1941, to
May 31, 1944

| | Mar. 1941- Feb. 1942 | Mar. 1942- Feb. 1943 | Mar. 1943- Feb. 1944 | Mar. 1941- Feb. 1944 |
|--|-------------------------|-------------------------|-------------------------|-------------------------|
| United Kingdom | 68.1% | 39.7% | 41.2% | 42.5% |
| U. S. S. R. | 6.3 | 29.2 | 28.9 | 27.6 |
| Africa, Middle East and Mediterranean Area | 13.2 | 14.0 | 14.8 | 14.4 |
| China, India, Australia, New Zealand | 8.4 | 13.0 | 10.6 | 11.2 |
| Latin America | 0.1 | 0.9 | 0.8 | 0.8 |
| Other Countries | 3.9 | 3.2 | 3.7 | 3.5 |
| Total | 100.0 | 100.0 | 100.0 | 100.0 |

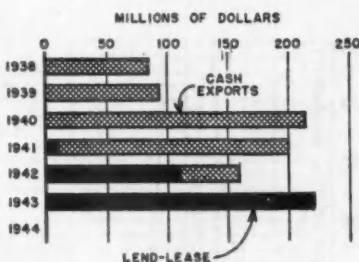
* These lend-lease export data, compiled by the Foreign Economic Administration, are for actual shipments of lend-lease supplies. Shipments of supplies consigned to U. S. commanding generals for subsequent lend-lease transfer are not included in the above lend-lease export figures. These consignments totaled \$658.6 millions to May 31, 1944, comprising \$411 millions to French forces in North Africa, \$224.3 millions to Chinese forces in the China-Burma-India theater, and \$23.3 millions to Allied forces in other theaters.

MACHINE TOOLS

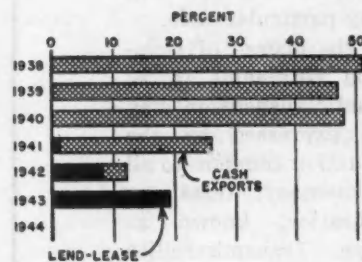
UNITED STATES PRODUCTION



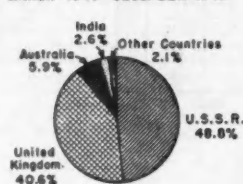
VALUE OF EXPORTS



EXPORTS IN % OF PRODUCTION

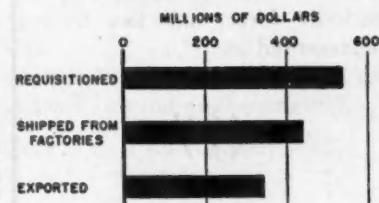


WHERE MACHINE TOOLS HAVE GONE UNDER LEND-LEASE



LEND-LEASE MACHINE TOOL PROGRAM

AS OF DECEMBER 31, 1943



* Estimated by War Production Board.

T

HE problem of isolating Diesel engine vibration resolves itself into a four-point program. First, the degree of isolation necessary to obtain ultimate performance must be established; second, an analysis of the engine characteristics and a determination of the type and degree of vibration disturbances must be made; third, from these, the proper spring stiffnesses must be calculated and the type of suspension selected; and, fourth, the individual mountings must be designed not only to fit the points of support but also to give the necessary loading characteristics.

The general concept of vibration isolation by means of an elastic suspension may be visualized as a mass suspended in space. If an alternating force acts on the body, the inertia of the mass is the only force available to resist it. Therefore, the entire mass is accelerated through a small vibratory motion. Practically this is not possible, but by using an elastic suspension, this ideal condition may be approached. If the suspension be made soft enough, the inertia resistance of the mass cannot follow the quick changes in direction of the accelerating force, with the result that the mass remains practically stationary. Thus the only force transmitted to the foundation is the spring force carried through the suspension as it oscillates with the movement of the suspended mass. Without an elastic system interposed between the mass and the support, the entire vibratory force would be directly transmitted to the foundation.

Although, theoretically, an elastically-suspended mass is free to vibrate in six degrees, three of which are translational in character in three separate planes, and three of which are rotational about three separate axes, usually one or two are all that need be considered in any particular case.

The degree of isolation obtainable in an elastic suspension may be expressed by the equation common to all elementary texts on vibration, known as the Transmissibility Ratio. It is the ratio of the transmitted force to the impressed periodic force, and is represented as:

$$T = \frac{1}{1 - \left(\frac{f_d}{f_n}\right)^2}$$

Where T = Transmissibility.

f_d = Frequency of the disturbing or impressed periodic force.

f_n = Natural frequency of free vibration of the machine on the elastic suspension.

$\frac{f_d}{f_n}$ = Frequency ratio.

The equation also represents the ratio of transmitted vibration to that which would exist with solid attachment.

Fig. 1 is the graphical representation of the transmissibility equation with the transmissibility plotted against frequency ratio. The curve indicates that at very low ratios of impressed frequency to natural frequency, the transmitted force is approximately equal to the impressed force, and therefore the suspended

Isolation of

mass follows in phase with the force and with the same amplitude. As the ratio increases and approaches the resonant speed, the transmitted force and amplitude of the mass increases until at resonance they are theoretically infinite in value. Actually some damping is usually present to limit the value of the force and amplitude. At resonance the phase angle

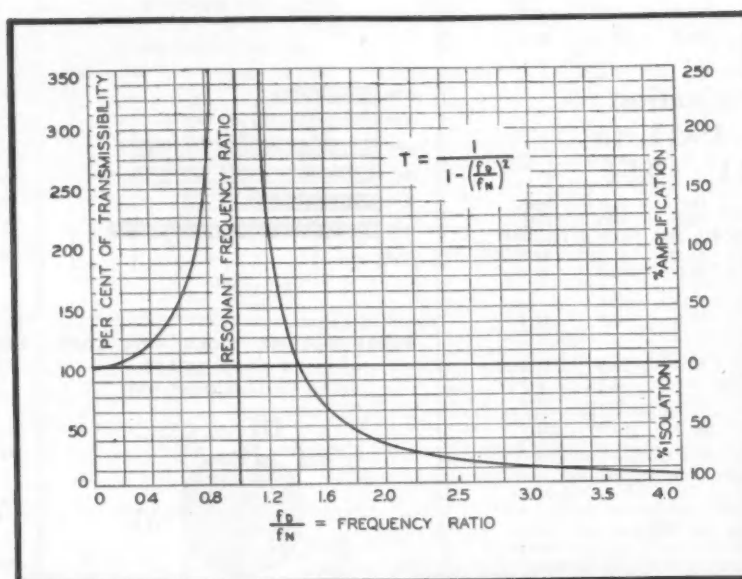
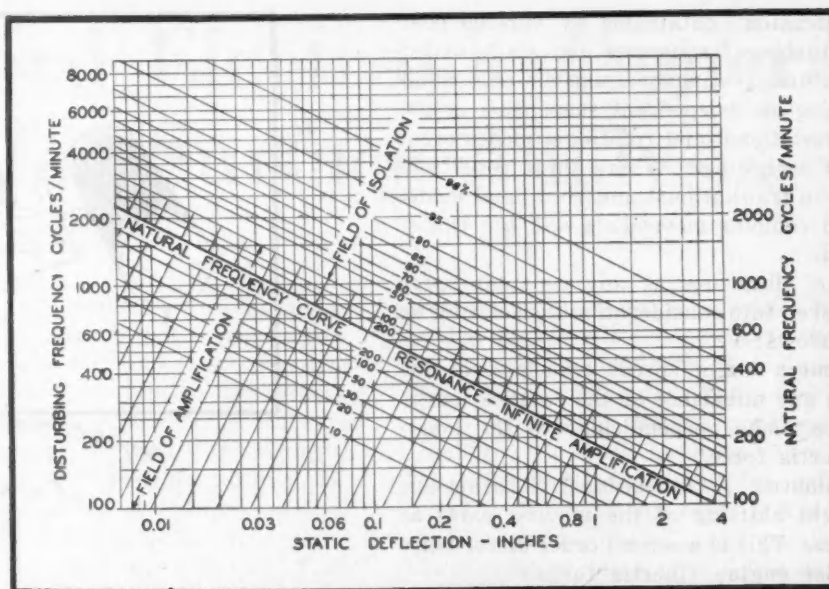


Fig. 1—Transmissibility curve

Fig. 2—Relation of natural frequency to static deflection. Relation of per cent isolation and per cent amplification to disturbing frequency and static deflection



Diesel Engine Vibration

shifts 180 deg out of phase and continues in this relation at higher ratios. As the ratio of speed continues to increase, the magnitude of the force and the amplitude decreases until, at the ratio of 1.41, the transmitted and impressed forces are again equal. Further increase in the ratio results in a decrease in the transmitted force and amplitude until they approach zero in value. At these high ratios, the mass remains practically stationary. Therefore, it is the last region of the curve which indicates the need of soft suspensions for low transmissibility.

Another way of expressing transmissibility in terms of isolation or amplification is shown by the scales to the right of the graph. Thus, transmission greater than 100 per cent may be expressed by the scale "per cent amplification," whereas, those less than that value may be expressed on a reversed scale as "per cent isolation."

At resonant speeds, the internal friction or damping of the springing material is the only factor which keeps the impressed force and amplitude from becoming infinite, thus damping is beneficial at and below frequency ratios of 1.41, but, above this ratio, it is extremely detrimental. In the majority of cases where steel or rubber is the elastic medium, the effect of damping may be omitted.

While the transmissibility curve is based on purely mathematical theory, its truth in relation to the actual performance of steel or rubber suspensions has been amply proved in practice. This same transmissibility

theory applies to torsional vibrations as well as translational.

The natural frequency or frequencies if more than one exists may be expressed by the following equations:

$$f_n = \frac{1}{2\pi} \sqrt{\frac{K_t}{M}} \quad \text{for translational vibration}$$

or

$$f_n = \frac{1}{2\pi} \sqrt{\frac{K_r}{I}} \quad \text{for rotational vibration}$$

where f_n = Natural frequency of the systems in cycles per sec.

K_t = Elastic restraint or spring constant lb per in.

M = Mass suspended = $\frac{W}{g}$

where K_r = Elastic restraint or spring constant, in.-lb per radian.

I = Moment of inertia, lb-in.-sec²

G = 386 in. per sec per sec.

W = Weight, lb.

The translational natural frequency can also be expressed in terms of static deflection of the suspension:

$$f_n = \frac{3.13}{\sqrt{d}} \quad \text{where } d = \text{static deflection in inches}$$

Fig. 2 illustrates graphically the relation between static deflection and natural frequency. The curve has also been designed to show the "per cent isolation" or

By H. H. Fink

Product Design Engineer,
The B. F. Goodrich Co.

"per cent amplification" obtainable by various combinations of disturbing frequencies and static deflections. These natural frequency equations only apply to a system having an independent suspension or one in which the translational and rotational modes occur independently of each other. Where these conditions do not prevail, the translational and rotational modes combine to form complex movements and the theory becomes involved.

The disturbing vibrations at any constant speed which must be taken into consideration in isolating an engine are as follows:

First order (one x engine speed) translational disturbances due to any unbalance of the rotating parts. These occur in a plane perpendicular to the longitudinal axis (inertia force.)

Inherent Unbalance: A translational vibration due to constant weight shifting of the moving parts as the engine rotates. This is a second order disturbance in a four cylinder engine (inertia force.)

Pressure Torque Impulse: The most serious vibration present in a reciprocating engine. The power impulse tends to rock the engine in a direction opposite to the crankshaft rotation at a frequency (in a four cycle engine) equal to the engine speed times one-half the number of cylinders. This results in a second order for a four cylinder engine, a third order for a six cylinder, etc.

Other occasional disturbances create vibrations of other orders. A misfiring cylinder in any four-stroke engine will set up a one-half order torsional vibration.

It at all possible the natural frequency of the suspended power-plant should be made lower than any operating speed of the engine. Quite frequently, this is not possible to do and still retain the required stability. However, since inertia effects increase with the square of the speed, and because the magnitude of rotational vibrations is small when the engine is delivering no power, it is not necessary to give much consideration to vibration at frequencies corresponding to idling speeds. Therefore, if necessary, resonance of the mounted engine can be made to occur at a low idling speed.

Careful consideration must be given to the proper design and location of the mountings if the elastic

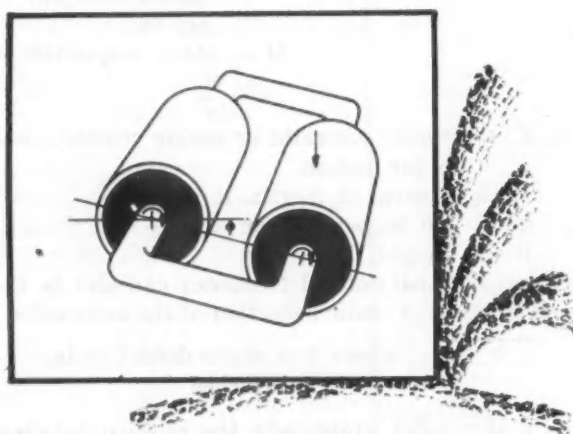


Fig. 3—Annular shear mounting as loaded

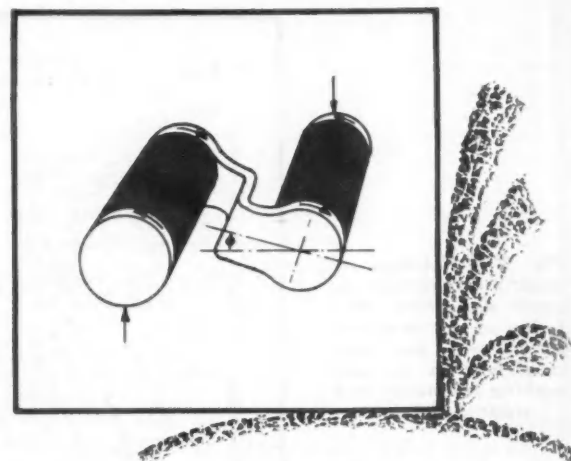


Fig. 4—Angular torsional shear mounting as loaded

suspension is to be effective. It is highly desirable to obtain a layout in which the various vibration modes act independently of each other. This requires that the mountings be placed as nearly as possible in a plane containing the center of gravity and the axis of oscillation. An independent suspension of this type allows alternating accelerating forces in a translational direction to produce true translational motion, and those in a torsional direction to produce true torsional motion. Also, it permits maximum flexibility with a minimum loss of stability, and is thus desirable in mobile installations where shock and abnormal accelerations are prevalent. If an independent suspension is not used, the translational and rotational motions combine, resulting in a complex movement of the power-plant. The resulting frequencies are quite complicated and the engine stability is greatly reduced.

Of the numerous materials available for use as isolating medium, rubber or steel appear to be the most outstanding. Steel springs have had the advantage in the past, in that they were able to isolate a larger range of vibrations due to the greater deflections obtainable through versatility of design. They are not affected by oil or temperature changes and have a long serviceable life. However, because of their low damping factor, it becomes necessary to add an external means of damping for resonant conditions. Their lack of stability without external means of support, together with their high sound transmitting qualities, is a definite disadvantage.

Rubber used as a springing material has many advantages. It has high resilience, a small degree of inherent damping which is beneficial at resonant conditions or when sudden impulses occur, the capacity for storing large amounts of energy per unit volume, and excellent sound isolating qualities. Rubber springs have a lack of static friction and require no lubrication. Rubber can now be fabricated into economical and effective springs and can be designed to control the stiffness and stability in any direction by means of the shape characteristics. Recent developments in versatility of design permit large deflections where previously small limitations were imposed. The life

(Turn to page 44, please)

Ford Electronic Camera for Surface Analysis

IMPORTANT postwar applications in determining why some bearings give much longer service than others of the same apparent quality are predicted by Ford Motor Co. laboratory engineers for the new diffraction electronic camera recently installed for test purposes. Built by the University of Michigan engineering department, the machine already has proved its merit by determining why aluminum from some sources gave difficulty in obtaining uniform spot welds on parts of the B-24 bomber, although of the same composition as satisfactory shipments from other sources. Specimens were placed in the machine and a stream of electrons shot against the surface to be analyzed. The varying patterns photographed on the sensitized glass plate of the camera were identified as different oxides deposited on the metal during processing. Each of the oxides presented a different degree of resistance when placed in the welding machine, but when adjustment of the welder was made to conform to the particular oxide, no

further difficulty was experienced in making the weld.

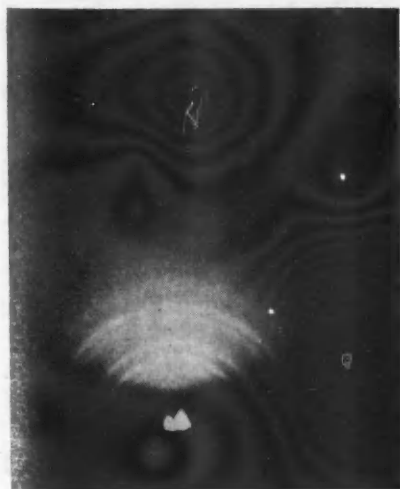
The camera quickly and accurately analyzes surfaces as thin as one millionth of an inch, providing ready identification of surface oxides and other film deposits too thin to yield samples for chemical analysis. Although little work has been done with it as yet on bearing life, Ford engineers forecast an important part for the camera in this field. It will be used first to investigate the chemical and physical changes that occur in bearing surfaces after a test run. It then will be used to determine what chemical or physical treatment

is necessary to produce a long-wearing surface or to change the molecular structure of the metal to give long life.

The machine also is useful to identify corrosive deposits left by degreasing agents or other metal cleaning compounds. It was found at the Ford plant that a chemical used to remove anti-welding oxides left other oxides equally undesirable. Suitable chemicals were tested with the camera and cataloged, resulting in improved welding.



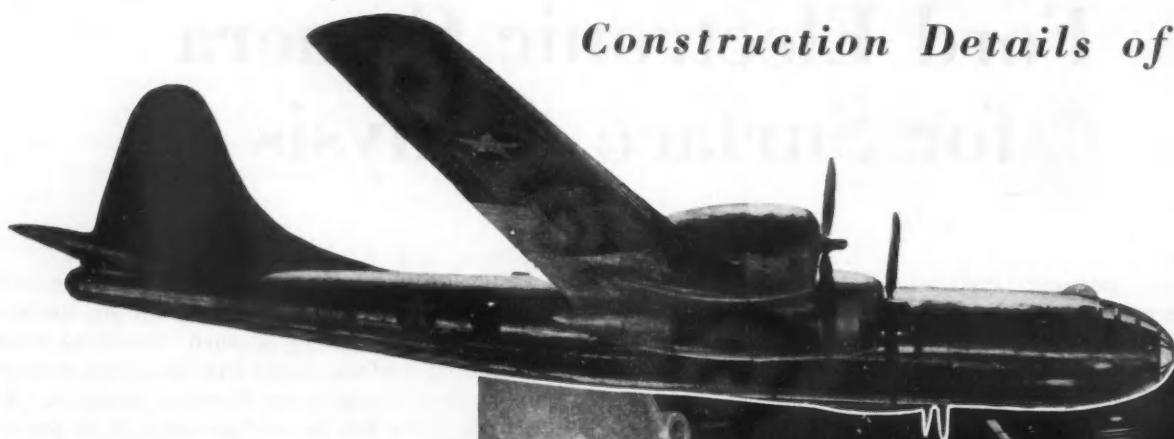
Diffraction electronic camera installed at the Ford Rouge plant laboratory. The technician is studying a negative taken by it.



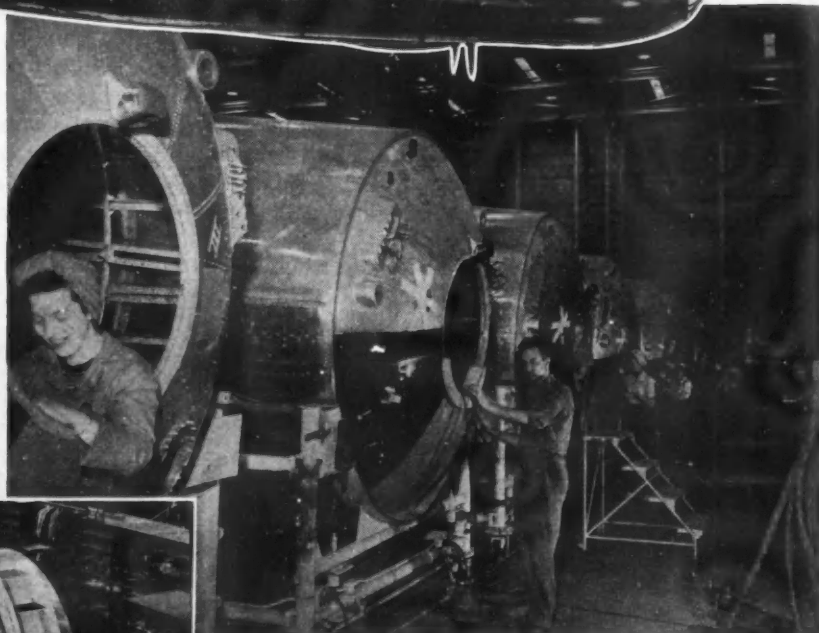
Surface patterns of Alclad sheet revealed by the diffraction electronic camera. The photo on the left was produced by a sheet with a good surface structure for spot welding; the one on the right by a poor surface structure for spot welding.



Construction Details of the



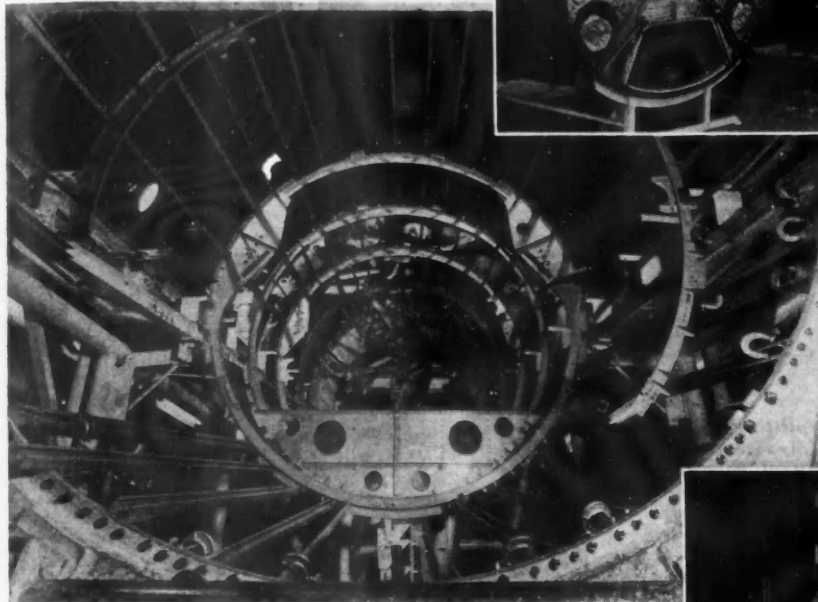
Fuselage midsections are here shown under construction. This portion of the bomber is installed behind the bomb bay section and ahead of the fuselage tail section. Bulkheads of pressurized sections are hemispherically shaped.



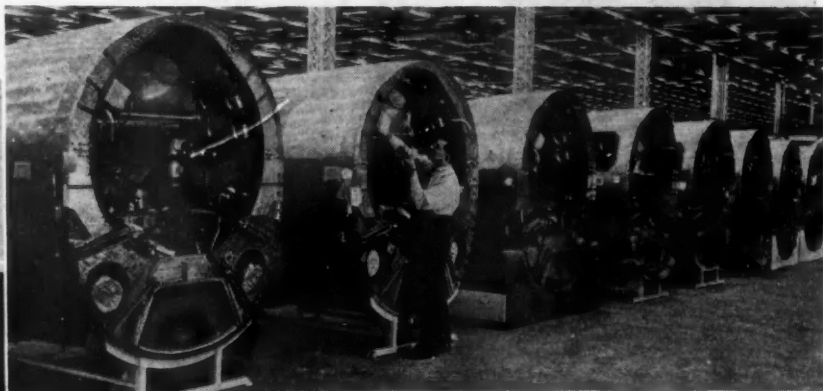
Interior (right) and exterior (above) views of Superfortress nose section. The photograph of the interior view was taken before the nose tip was affixed to the section. The girl at the rear is standing below the opening into the communication tube which passes through the unpressurized bomb bay. The exterior view shows the nose tip assembled to the nose section. The sections are turned in their jigs while under construction. This accounts for the absence of window openings in the second nose section.



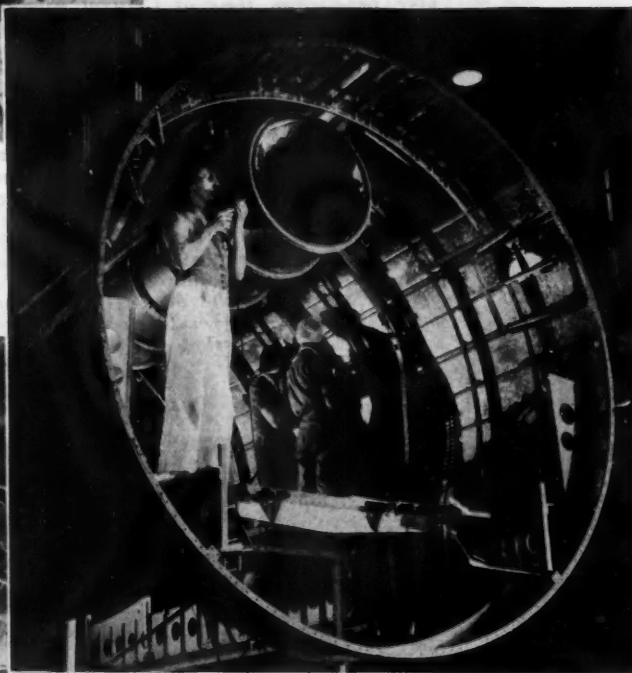
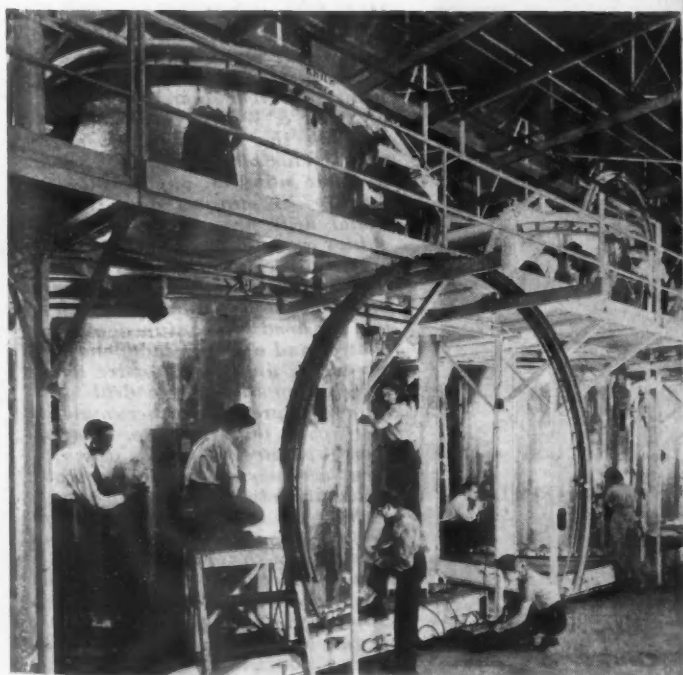
Boeing B-29 Superfortress



Circumferentials and stringers are being formed into the skeleton of a fuselage section. When these members are riveted together, the section will be ready for the outside skin. The fuselage is made in five sections.



This photo gives an idea of the tremendous size of the nacelles used to house the 2200 hp Wright engines that power the Superfortress. They are larger in diameter than the fuselage section of some airplanes.

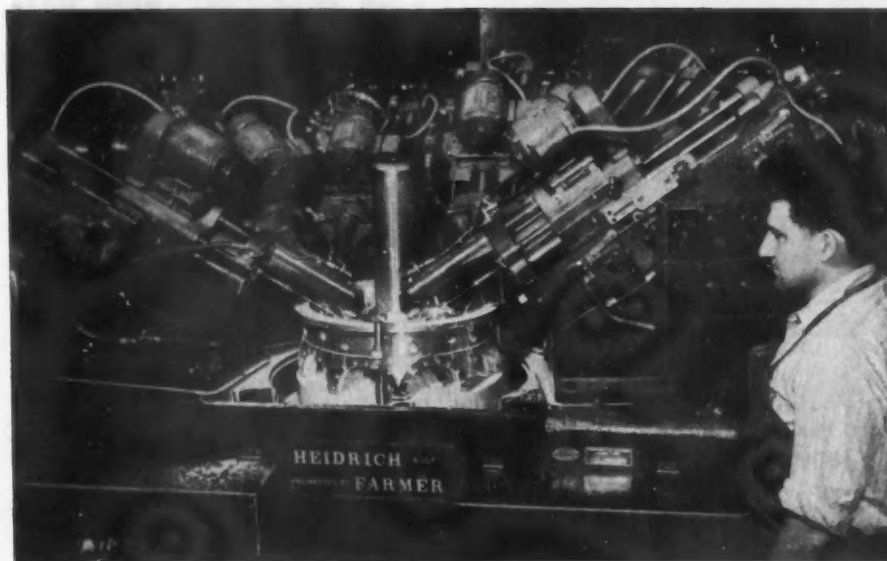
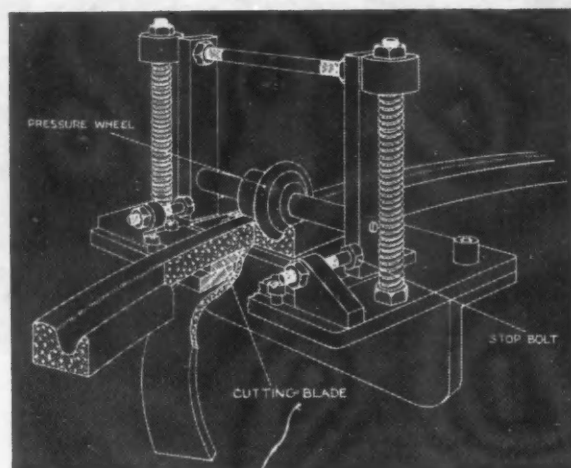


Interior (above) and exterior (left) views of bomb bays. The tube in the top part of the unpressurized bomb bay, shown in the interior view, provides crew members with means of access between the pressurized nose and pressurized midsection of the ship. The exterior view shows the bomb bay sections in the jigs and the circumferentials on the rack in the foreground. There are two separate bomb bays in each plane.



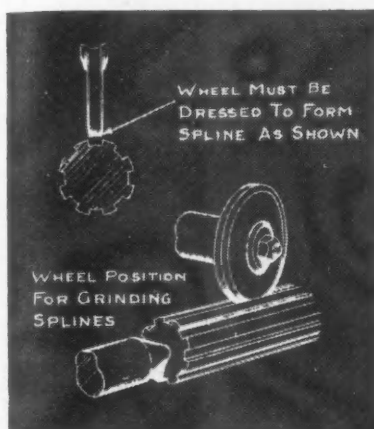
↑ Ends of certain aluminum alloy tubes for aircraft must be protected until they are to be installed. At the Consolidated Vultee Aircraft Corp. the ends are protected by applying Plastalloy to them. This new method is said to save more than \$6000 a year at one Convair division.

→ A gasket shaver, a device for splitting gaskets in one smooth continuous cut, is saving valuable production time at General Electric's Erie Works. It is used to cut down to proper thickness the rubber gaskets used on a certain piece of equipment. These gaskets, although only an inch wide, are about 15 ft in length. This simple shaver was made from odds and ends found in the plant. The cutting blade is a broken file ground to razor sharpness. The pressure wheel is the only machined part used, being made to conform with the shape of the gasket. Adjustable nuts on either side of the shaver make possible cuts of varying thickness. In operation, one end of the gasket is placed on the cutter, held in place with the pressure wheel, and pulled forward. The result is an evenly split gasket.



↓ Here is one of the two torque tension control deep-hole drilling machines that has made possible a big reduction in the time to drill the front and rear crankcase sections of Pratt & Whitney engines being built at the Ford aircraft engine plant. This machine drills 18 holes in three minutes, an operation requiring 15 minutes on a conventional drill press. These two machines are said to be the first to incorporate torque tension control at the drill, thereby keeping drill breakage at a minimum. Each of the six heads is equipped with the control and operates independently, advancing until an excessive torque force is applied to the drill either by undue pressure or accumulation of chips in the drill flute. The unit then operates a relay, which in turn actuates a solenoid-operated hydraulic valve, causing the head to return to the starting position. From this point it returns in rapid traverse to the position at which it encountered the excessive torque. The principle of the machine is amplification by electronics of the torque load variations of an electric motor.

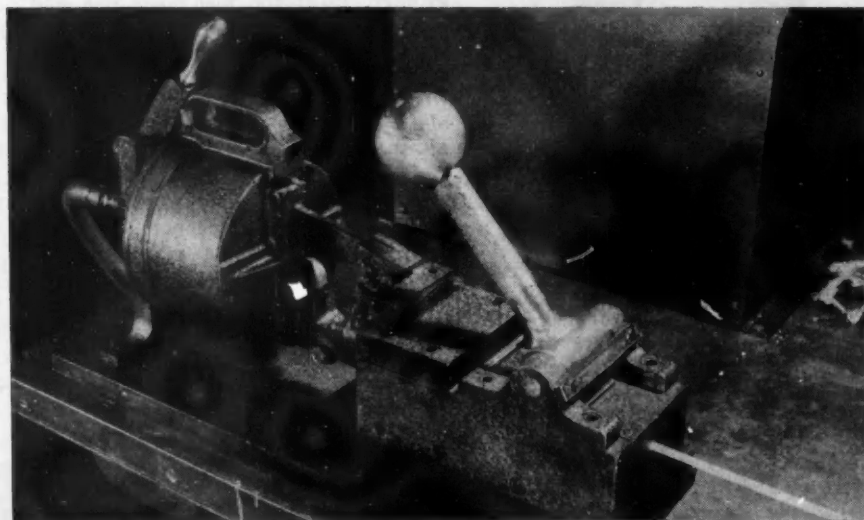
Cuts



After several months of experimental work with various wheels, coolants and table feed rates, the Aircraft Engine Div. of the Packard Motor Car Co. developed a system whereby external splines can be cut in one operation, the combination of the three factors depending upon the material worked on and the shape and depth of the spline. Heretofore, standard practice had been to take three to seven cuts, with rapid table feed and a moderate flow of grinding oil. The new method increased production over 100 per cent and it is necessary to dress the wheel but once every six or eight pieces as compared to at least once per piece previously. Consequently, there has been a saving of diamonds and dressing wheels.



An example of the success of arc welding as a high-speed production tool in military truck manufacture, according to the records compiled by The Lincoln Electric Co. is at the C. R. Jahn Co. plant where frames are being made for Army trucks at a rate 50 per cent greater than by former methods and at a cost saving of 50 per cent. The frames, which range up to 32 ft in length by 12 ft in width, are for trucks of 16-to-50 ton capacity. Heavy beams and channels, $\frac{1}{4}$ -in. in thickness and from 52 to 72 lb in weight, are cut to shape and fused with the electric arc into rigid, single units. Modern fillet welding technique is used throughout, 324 ft of welding being required for the 16-ton truck frame and 600 ft for the 50-ton size. The largest 50-ton job requires only about 200 man-hours to complete. The photo shows welding operations on a 50-ton truck frame.

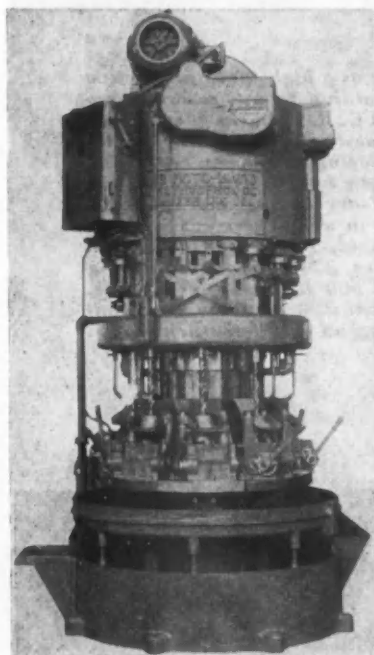


This tube beading device developed at the Glenn L. Martin Co. consists of a pneumatic squeezer with two sets of blocks cut out for $\frac{1}{4}$ -in. tubing. One set of blocks is stationary and the other movable. The tube to be beaded is clamped securely in place in the stationary blocks, with the end upon which the bead is to be raised extending out through the cup shape opening and into the movable blocks where it is likewise clamped. Both sets of blocks are actuated by a cam clamp. After the tubing has been clamped in place, a pneu-

matic cylinder pushes the movable blocks forward, compressing the tube and to form the bead. The height of the bead is controlled by the movement of the cylinder arm and the size of the cutout in the blocks. The new method shortens the tube about $\frac{1}{8}$ in. but this can be easily compensated for in the development of the true length. At the same time, the new tool offers a further advantage in that it increases the wall thickness of the tube in the area around the bead. It is shown in the above illustration.

New Production Equipment

DAVIS & THOMPSON CO., Milwaukee, Wis., has designed and built a vertical "Roto-Matic" driller which is an adaptation of a basic 36-in. work circle machine with 12 spindles to one with eight spindles, incorporating the same power and capacity for work. Fixtures are designed to take a cluster gear requiring the drilling of a 1-35/64 in. diameter hole 4 in. long. These fixtures are so constructed that they can, at a later date, when the current production program is completed, be

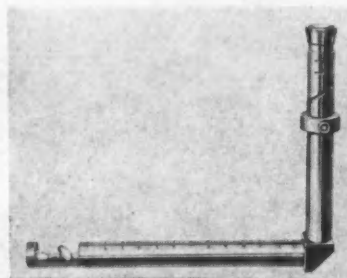


Roto-Matic driller

adapted to a larger cluster gear which requires a larger diameter hole 7 in. long. The machine is provided with speed and feed change gears to conform to later-day spindle speed and feed requirements.

The machine is of the non-indexing type. All that is required of the operator is to lay the rough pieces into the fixture and depress lever to clamp. Finished pieces are removed after the machine has completed a rotation. Feed of spindles and travel of machine are automatic.

ORIGINALLY designed for the internal surface inspection of gun bores, Polan Borescopes are now made available to private industry by Polan Industries, Huntington, W. Va. Borescopes make the surface of long bores visible to the human eye in order to



Polan Borescope

inspect for minute cracks or other surface faults which may cause failure in operation.

Borescopes are recommended by the maker for close scrutiny of internal surfaces of bored engine shafts, tubular bodies, hydraulic and other cylinders, etc., and will cover a diameter range from 13/16 in. to 9 in., and a bore length up to 30 ft.

A number of special borescopes and a wide variety of special attachments are available.

CONTINENTAL MACHINES, INC., Minneapolis, Minn., has just brought out the Model G-1 DoAll surface grinder. Built for tool room use and light production work where accuracy is paramount, it has a table travel of 21 in. and transverse travel of 7½ in. with a vertical wheel head adjustment of 12 in. using a 7-in. by ½-in. by 1¼-in. wheel.

An especially constructed combined hydraulic control unit eliminates all piping. This one unit controls the five hydraulically actuated movements of the machine and was designed especially for this grinder so that no adjustments are necessary.

When the surface grinder is under automatic operation, the cross feed screw disengages automatically. This



Model G-1 DoALL surface grinder

adds to the life of this important feed screw for use in manual operation.

Standard equipment on this new surface grinder is the direct motor driven, precision ball bearing spindle. The grinder spindle head is built especially for this spindle and is lapped for a precision fit. The wheel head is raised or lowered by means of a graduated hand wheel operating the vertical adjustment screw through a single gear contact for positive movement.

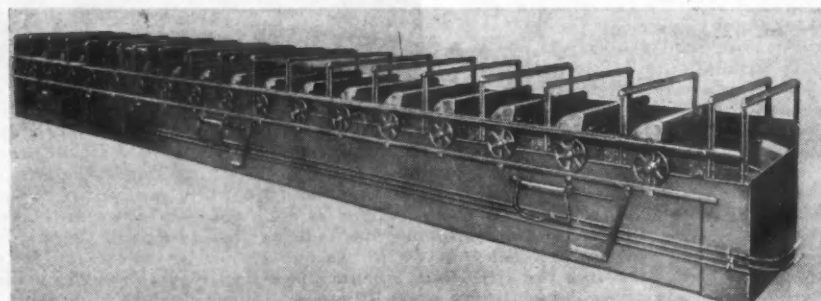
THE Udylyte Corporation, Detroit, Mich., has developed equipment and processing for Dichromating of zinc coated steel and die cast parts which is said to show great promise in the post-war field.

The construction of the machine shown here is based upon the discovery that absolute control of both time and temperature is vital in producing satisfactory results.

This equipment is fully automatic, eliminating all the irregularities of the old hand-dip method and carrying bulk parts through a complete processing cycle by means of a split timed dwell schedule.

Parts being processed are cleaned, rinsed, dipped, drained and dried continuously with dependable results and no scratching or scarring. Equipment is custom built to meet individual requirements.

(Turn to page 67, please)



Udylyte Dichromating equipment

Planned *Materials* Handling

is Vital Part of Planned Production

by Ezra W. Clark

Vice President and General Manager of
Clark Truetractor, Division of Clark Equipment Co.

DURING the late lamented, lush "days of the Empire," when every garage had two cars in it—both full of gas—John Jones, manufacturer, had worked out a factory routine which was the envy of all who saw it operate; and though his costs were decidedly "his business," they were so low as to throw desperation into the camps of his competitors. Not the least factor in Jones' mastery of volume production at low cost was a materials handling system which defied all efforts to improve it. Not that a good many well-trained minds didn't tackle that assignment, including the agile mind of Mr. Jones himself; for you could say this about John—he was never satisfied. No matter how good a thing was—be it product, machine, material, method—it couldn't be perfect; and never did John Jones relax his vigilant search for ways to make it better. Fundamentally, the success of the Jones method of handling materials was due to one exceedingly simple discovery of a rather obvious fact: proper handling of materials must be planned and developed as an integrated part of planned production.

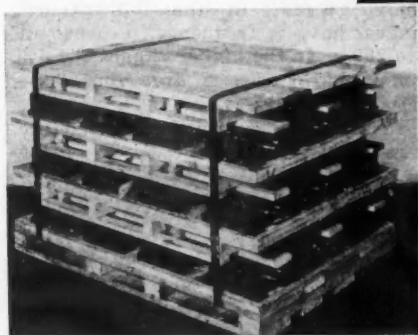
There it is: Materials handling is not a thing by itself—it must be studied and perfected as a part of the over-all production plan. In the prewar Jones plant was to be found every conceivable labor saving and time saving method and device. Material schedules were planned down to minutest details—and strictly observed. Materials flowed in on punctually kept time tables, were stored where they could be most easily fed to the production lines—all with a minimum investment of man-hours and dollars. The best proof of the system's effectiveness was that it worked.

Came the war—and Jones & Co., along with thousands of others, old and new, enlisted in the country's service, became a unit in America's vast war production. "Make it better, make it in enormous quantities—and make it faster": that was the modest assignment laid on the desk of American industry. So in-

dustrial got busy and did all three. Materials, methods, design—all were studied to find better ways, short cuts, faster methods. And along with every other phase and operation of modern manufacturing, materials handling came in for its share of attention. Materials had to be handled faster, more efficiently, in order to get the work done on time.

John Jones tackled the problem—and got results. He found, for one good example, that a major unit purchased complete from an outside supplier, reached his plant securely crated—two units to the crate. After removal from the cars, these units were first un-

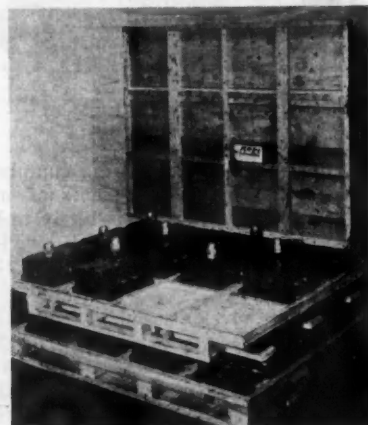
(Turn to page 81, please)



(Above) Valve shipments were originally made in this type box

(Left) This is the redesigned pallet used for shipment of 36 valves

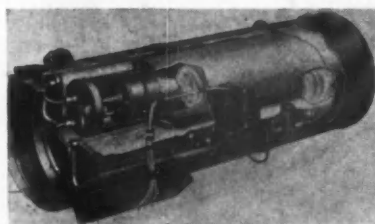
A knock-down view showing construction of the unit pallet



New Products for Aircraft

Aircraft Heaters

The series SRH aircraft heaters developed by Anchor Post Fence Co., Baltimore, Md., embody a new combustion process known as vapor entraining, which uses a capillary vaporizing block in conjunction with pre-heated combus-

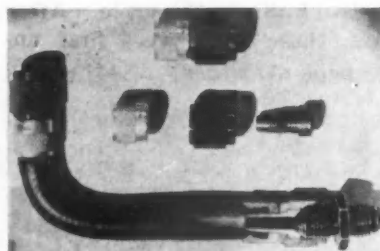


Series SRH aircraft heater

tion air. To avoid lead oxide formations and prolong life of burner parts the flame is completely suspended. An unusually low pressure drop permits efficient operation at low ram pressures. The flame is said to be so stable that its characteristics are the same regardless of the plane's altitude or speed, and barometric compensation permits operation up to 40,000 ft.

Reusable Hose Fittings

Aeroquip Corporation, Jackson, Mich., makes available Aeroquip detachable, reusable hose fittings for use with low-pressure hose. (Specification AN-ZZ-626a.) Aeroquip hose lines can be made up or replaced without special tools. All parts of the fitting assembly are removable and reusable individu-



Aeroquip hose fittings

ally thus eliminating stocking complete subassemblies. This feature is of importance because the nut is likely to be damaged in installation and service more frequently than other parts of the fitting assembly.

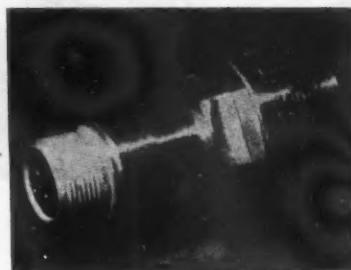
The fitting may be assembled and disassembled with a common wrench by holding the hose with one hand. Making the assembly involves screwing the fitting together without regard for

torque. The assembly requires no tightening, no adjusting, no continued future servicing. Fittings may be used over and over again.

Differential Type Dynamic Pressure Gage

Trimount Instrument Company, Chicago, Ill., has announced a new dynamic pressure gage of the differential type made in ranges of 0 to 1000 lb and in intermediate ranges as low as 0 to 1 lb. These gages, in the low-pressure ranges, have a frequency response of 0 to 200 c. In the higher ranges the dynamic characteristics are from 0 to 500 c.

Electrical characteristics—impedance



Trimount dynamic pressure gage

bridge type for operation with 2000 cycle carrier equipment. Input, 5 v across gage bridge circuit. Output, 7 mv. Style of electrical connections can be furnished as specified by user. Standard pressure connections are $\frac{1}{8}$ in. NPS. Bodies of gages designed for high-pressure work are of stainless steel. Those pickups which are specifically designed for air-foil studies are of aluminum.

Edison-Splitdorf Aircraft Magneto

The latest product of the Edison-Splitdorf Division of Thomas A. Edison, Inc., West Orange, N. J., is the new Edison SF9LD-I aircraft magneto that is more than 6 lb lighter than any others of the same capacity according to announcement by that subsidiary.

By careful experimentation and research it was possible to limit the weight of this instrument to approximately 9 lb without sacrificing any of the electrical output, mechanical strength, or all around efficiency expected of magnetos designed for this class of service. This was accomplished without the use of any light metals other than aluminum.

In order to provide the compactness and accessibility necessary with a magneto of this design, a very light

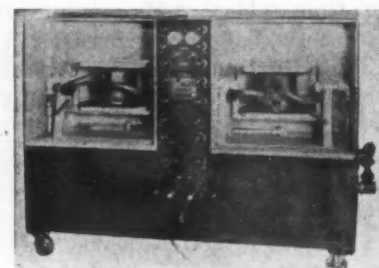


Edison-Splitdorf SF9LD-I magneto

two-pole rotor is carried vertically on ball bearings. The lower end of the rotor shaft is serrated, over which is fitted the spiral bevel pinion which is driven by its mating gear located on the magneto drive shaft. This ratio is 1:2 (one revolution of the drive gear makes two revolutions of the rotor). It is by virtue of this gearing that a two-pole rotor is made to do the work of a four-pole rotor but with greater efficiency and a reduction in weight.

Cleaner for Oil Temperature Regulators

A new machine for cleaning aircraft oil temperature regulators, the Turco Surj washer, is offered by Turco Products, Inc., Los Angeles, Cal. Seven different cleaning operations are performed in sequence by the turning of valves conveniently positioned in a panel on the front of the Surj washer. As the various solutions are put through it, the regulator is revolved by the cradle with abrupt changes of speed which sets up a positive surging action. As there are two cleaning compartments in the Turco Surj washer, individually controlled, several regulators can be cleaned on one side while a particularly dirty one, requiring prolonged cleaning, can be handled on the other cradle.



Turco Surj washer

TURNING UP PRODUCTION SCHEDULES WITH INDUSTRY'S NEW RIGHT HAND

Production-line Efficiency in a Single Piece of Equipment!

Indexing tables put wings on many production operations—as effectively as the revolving pistol barrel put wings on trigger fingers!

And wherever quick, accurate indexing can help production, **HydrOILic** equipment offers distinct advantages. **HydrOILic indexing presses** show why. Their hydraulically operated tables position the work with higher precision. Rapid, continuous operation is achieved by merely feeding and emptying the table. Safely too, because hands are never near the ram.

“Start and stop” shocks of indexing tables are overcome, because *oil* is the medium through which they are propelled. Oil (and the speed of the tables) can be regulated instantly without wear or strain, and with absolute accuracy. That's why **HydrOILic** equipment has proved so effective in speeding up such wartime jobs as shell loading and crimping, powder compressing . . . as well as many pressing, pushing and lifting operations.

Why not get together with Denison **HydrOILic** engineers on your problems or ideas? Write. The

Denison Engineering Co.,
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Columbus, Ohio



DENISON
EQUIPMENT *in* APPLIED
Hydr *ics*

Isolation of Diesel Engine Vibration

(Continued from page 34)

expectancy of rubber springs can be long if properly compounded, designed, and cared for.

It is true that rubber is affected by contact with oil and by temperature changes. Synthetic rubbers would be more suitable in this respect. The creep and damping properties of rubber vary with load, temperature, and frequency. Also, the dynamic properties differ somewhat from the static properties. However, on an overall basis of comparison, rubber appears to be the most suitable springing material for elastic supports.

Rubber can be used as a springing material when loaded in tension, compression, or shear, since the deformations are great under any of these methods. The type installation, available space, direction of forces, freedom of movement, and the physical characteristics required in the mounting will dictate the proper selection as each method has its advantages as well as its disadvantages. Rubber loaded in tension has been given little consideration in the mounting of engines because it is easily damaged, resulting in progressive tear and ultimate premature failure.

The load-carrying capacity is very high when rubber is loaded in compression, but the rate of stiffening is also very great. Thus the compression modulus and, consequently, the elastic restraint are variable functions. The deflection characteristics not only depend on the hardness of the compound but also on the size and shape of the mounting. For maximum service life, the deflection of rubber used in compression is usually maintained below 20 per cent of the undeformed thickness. Present day applications use this method primarily as a counterpart of the design of shear type mountings where snubber action is desired. The rubber can be so proportioned to give any degree of build-up resistance to overloads.

With the advance in the development of rubber-to-metal adhesion, the use of rubber in shear has increased tremendously. The deflection characteristic in shear is for all practical purposes, a straight line function throughout the working range, and therefore the shear modulus is constant. For the same unit loading and thickness, rubber in shear has six or more times the deflection of rubber in compression. The same deflection in shear could be accomplished with less than one-sixth the amount of rubber necessary in compression. It may be generally stated that for normally stressed applications, shear type rubber can easily carry loads ranging from 50 to 100 psi on the bonded area, as the ultimate bond strength is approximately 300 psi. Good practice

limits the deflection of shear type mountings to two-thirds of their thickness and the thickness is limited to that of the smallest dimension of the bonded side, or a maximum of two inches. This insures uniformity of cure and stability.

In the design of rubber mountings, the three types of loading cannot be considered independently of each other, for a mounting may function in shear in one direction but any forces perpendicular to the shear plane place the rubber in compression and vice-versa. By a combination of all three methods of loading, i.e., tension, compression and shear, it is now possible to design rubber springs for almost any desired loading conditions. Stability or lack of stability can be incorporated as required.

Series mountings, whether they be compression or multiple shear plate types, as well as the double shear plate, are designed to obtain large deflections and, at the same time, retain stability. These styles are soft in all directions in the shear plane, but are stiff in the one direction of compression.

The tubular and multiple tubular shear type have the advantage of being soft in one direction only, that of shear. They are quite stiff in all directions in a plane perpendicular to the shear axis.

The annular and multiple annular torsional types (Fig. 3) are also a one directional style. They deform little under any radial load but are quite soft in torsional shear. By means of torsional arms, large deflections can be obtained. This design has the advantage, in that rubber forms its own bearing and that it is capable of sustaining great loads.

The angular torsional shear type (Fig. 4) is normally soft in two directions. The versatility of design possible with the multiple angular torsional shear arrangement as shown is very far reaching. This design permits a wide range of physical characteristics by slight alterations in the dimension of the rubber thickness, rubber diameter, or of the length of the inter-connecting arm. Extreme deflections can be secured under very light loads and freedom of movement is obtainable in all directions.

The design of rubber mountings can now be classified as a predictable science and placed in the same category as that of steel and other structural materials.

Thermocouple Spark Plugs

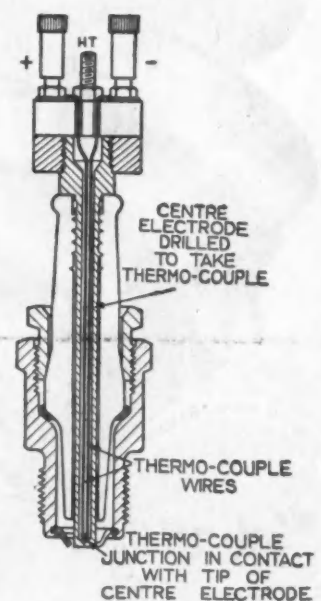
| Speed m.p.h. | Temperature deg. C. | | |
|-----------------|---------------------|------------|------------|
| | No. 1 Cyl. | No. 3 Cyl. | No. 6 Cyl. |
| 30 | 520 | 480 | 480 |
| 40 | 580 | 500 | 500 |
| 50 | 690 | 580 | 580 |
| 60 | 850 | 700 | 700 |

Variations of temperature in three cylinders of a six-cylinder engine under running conditions as recorded by means of a thermocouple plug.

FOLLOWING investigations into the temperatures of spark plug insulators and electrodes under operating conditions in various types of engines, the Lodge Spark Plug Co., England, developed a complete range of their standard plugs with a thermocouple located 0.031 in. from the end of the central electrode. These thermocouple plugs show that pre-ignition commences when the electrode temperature reaches 2040 to 2130 F., the exact temperature depending upon various factors, such as the compression ratio, type of fuel, etc.

Apart from enabling engine manufacturers to adopt a type of plug that is neither too hot or too cold under running conditions in the particular engine, the thermocouple plug enables engine designers to compare the temperatures in the different cylinders of the same engine. Any differences in gas distribution or cooling are immediately indicated. That such differences may be considerable is shown in

the accompanying table giving the temperature differences in three of the cylinders of six-cylinder engine. The Lodge thermo-couple plugs are said to have a service life comparable with that of standard plugs and, used in conjunction with a millivoltmeter, to give temperature readings with an accuracy of plus or minus four deg.



Lodge thermocouple spark plug, automobile engine type.

HYDRAULIC BALANCE

CANCELS OUT BEARING LOADS

And Means MUCH LONGER PUMP LIFE

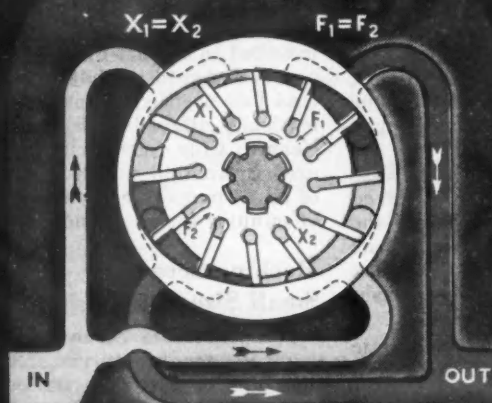


Diagram showing patented "Hydraulic Balance" construction.

VICKERS Balanced VANE TYPE PUMPS



As illustrated by the diagram above, equal and opposing pressure areas are provided on the outlet side and on the inlet side of Vickers Balanced Vane Type Pumps. The equal and opposing radial hydraulic thrust loads cancel each other . . . consequently there are *no* bearing loads resulting from pressure. The major cause for wear is thus completely eliminated and the result is much longer pump life. This "Hydraulic Balance" construction is exclusive with Vickers Vane Type Pumps; it also permits an unusual design compactness and is an

important reason for the exceptionally high efficiency of these pumps.

Vickers Balanced Vane Type Pumps are available in single-stage for 1000 psi (see Bulletin 40-25a); two-stage for 2000 psi (see Bulletin 40-16) and also two-pressure, large-small volume (see Bulletin 38-14). Vickers Application Engineers will gladly discuss with you the many different types of hydraulic power and control circuits on which these pumps have improved machine performance. Write the office nearest you.

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Application Engineering Offices: CHICAGO • CLEVELAND • DETROIT • LOS ANGELES • NEWARK • PHILADELPHIA • ROCHESTER • ROCKFORD • TULSA • WORCESTER

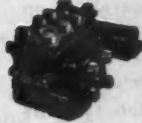
**Representative of More than 5,000 Standardized Vickers Units
for Every Hydraulic Power and Control Function**



CONSTANT DELIVERY
PUMPS



FLUID
MOTORS



DIRECTIONAL
CONTROLS



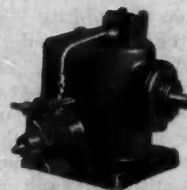
VOLUME
CONTROLS



PRESSURE
CONTROLS



CONTROL
ASSEMBLIES



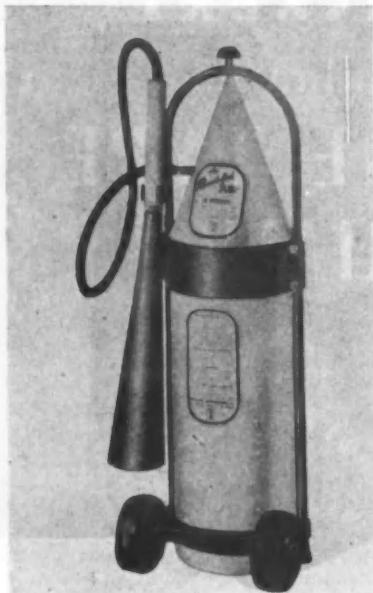
VARIABLE DELIVERY
PUMPS

New Products

Carbon Dioxide Fire Extinguisher

Randolph Laboratories, Inc. Chicago, Ill., has produced a 25 pound wheel-type carbon dioxide fire extinguisher that is moved and operated with uninterrupted, single-sweep action.

The Randolph "25" features an exclusive palm-trigger valve, mounted on the extinguisher steel handle. By



Randolph "25" fire extinguisher

grasping the handle, the operator can move the unit and press the release button with one hand—discharging a blanket of carbon dioxide in an arc of 10 to 20 ft. Release of pressure on the palm-trigger automatically stops the flow of carbon dioxide gas and retains the remainder of the charge for repeated attacks.

Synthetic Rubber Latex Insulation

Nubun, a new synthetic rubber latex insulation for power, lighting and communication cable has been brought out by United States Rubber Company, New York, N. Y.

Qualities of Nubun insulation, include flexibility, impermeability to water, laminated construction, and perfect centering of the conductor to produce an insulated wire of maximum conductivity and minimum diameter. The synthetic insulation is said to be exceptionally homogeneous following vulcanization and to have high electrical characteristics such as dielectric strength and insulation resistance.

The special synthetic rubber compound is low in specific conductive capacity, has good aging qualities because of the presence of special anti-oxidants, and will resist severe wear because by the will resist severe wear.

Synthetic Latex Foam Rubber

A Process to produce foam rubber from synthetic latex has been developed by The Firestone Tire and Rubber Company, Akron, Ohio. The new synthetic product can be produced in soft, medium and firm densities, and volume production of it already is under way in Firestone factories.

The finished material compares so favorably with the natural foamed latex which Firestone made before the war that the same name "Foamex" has been given the new product. Foamex is extremely light; it is odorless, washable and sanitary. The cost is low.

The tensile strength of the synthetic material is equal to or greater than that made with natural latex, and it can be made to remain flexible at temperatures ranging down to 40 degrees below zero.

Synthetic Resin Adhesive

Pliastic cement is the name of a synthetic resin adhesive just introduced by Paisley Products, Inc., Chicago, Ill. It is a soft white fluid cement that may be used in its natural state or reduced with water. Application is by brush, gumming machine, spreader, dipping, flow or spray gun. The manufacturer states that Pliastic is compounded of selected resin bases with complex non-resin materials to yield a tough, pliable, continuous film capable of joining many combinations of materials.

The Pliastic film, when dry, is a semi-transparent, glossy, flexible coating which is said to have excellent heat sealing properties.

Vaporizing Liquid Type Fire Extinguisher

A light-weight, vaporizing liquid type fire extinguisher called S.O.S. Fire Guard, is offered by the General Detroit Corporation, Detroit, Mich. Because of its small size (1 or 1½ quart), the Fire Guard may be installed on trucks, cars, boats, and planes. Its action is said to be particularly fast on electrical, oil and gasoline fires.

One of the features claimed for this fire fighter is a patented "Safety Phlare" design of the lower end of the pump cylinder. The cylinder is expanded

at the bottom to insure immediate free-floating piston action even after long periods of disuse. Yet in the remainder of the cylinder felts fit snugly to insure top operating efficiency. Absence of metal to metal contact in the expanded section eliminates the possibility of piston sticking to cylinder wall.

Carbon Remover for GM Diesels

Removing the carbon from the air intake ports of the GM 2-cycle Diesel engine is a matter of minutes with the new Stuart carbon removal tool made by Stuart Engineering Division, Chicago, Ill. Ports can be cleaned with the Stuart tool without removing the pistons or pulling the cylinder sleeves. The head of the device which carries two rows of eight punches each, is mounted to a shaft by an eccentric cam and is designed so that when it is lowered into position the punches are automatically aligned with the ports to be cleaned. Only four turns of the handle are required to punch the carbon out of all 64 ports in each sleeve—a matter of minutes for all cylinders.

Machine Screws in Small Sizes

Manufacturers Screw Products, Chicago, Ill., manufacturers of the strong-hold line of fastening devices, has increased the range of sizes of its "Perfection in Miniature" machine screws.

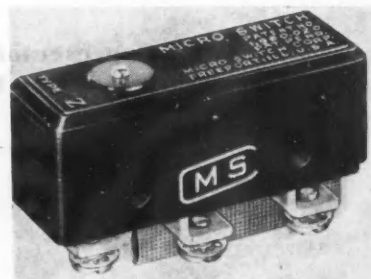
These screws are now available in 0-80, 1-64 and 1-72 thread diameters, steel and brass.

Split Contact Micro Switch

A new line of split contact Micro switches has been placed on the market by Micro Switch Corporation, Freeport, Ill.

By the use of the double throw split contact Micro switch, it is possible, for instance, to switch operation from a direct current control to an alternating current control. Two sets of contacts are mechanically interlinked but electrically isolated. The Micro switch transfer action is a matter of but a few milliseconds.

It is also possible with this switch to control four isolated circuits by pairs, eliminating the use of relays and other isolating means from the circuit.



Micro switch

The CONE AUTOMATIC MACHINE COMPANY



sees many

GOOD THINGS AHEAD

It is reported that

Instant-starting fluorescent lamps in a greater variety of shapes and sizes are promised after the war.

get ready with CONE for tomorrow

A laboratory model of an electron microscope has been made that fits into two suitcases and weighs 133 pounds.

get ready with CONE for tomorrow

One large processor of cereals intends to go into the manufacture of electrical appliances for use as premiums.

get ready with CONE for tomorrow

An aircraft manufacturing company has announced its intention of manufacturing washing machines and refrigerators after the war.

get ready with CONE for tomorrow

Natural gas is being frozen and stored for emergency use in one American city. It is believed possible to ship gas in this form from the oil fields to Eastern markets.

get ready with CONE for tomorrow

The American Petroleum Institute reports that proved reserve sources of crude oil are sufficient to meet requirements for "many generations".

get ready with CONE for tomorrow

A waterproof match has been developed for jungle use and should be a convenience to hunters, campers, and fishermen after the war.

get ready with CONE for tomorrow

The Navy is using concrete storage tanks for gasoline. Seepage is prevented by painting the inside with sodium silicate.

get ready with CONE for tomorrow

A new chromium plating salt is claimed to be more economical and non-poisonous.

One large manufacturer of automotive engines will have a lightweight, air-cooled, four-cylinder opposed engine, based on its aircraft engines, for low-priced, post-war automobiles.

get ready with CONE for tomorrow

A special new remover makes it possible to strip the paint from blacked-out windows with a hose and cold water.

get ready with CONE for tomorrow

A device, now being added to large radial aircraft engines, injects water into the combustion chamber for better cooling, less detonation, and greater fuel economy.

get ready with CONE for tomorrow

A new tool prevents wrinkles in pressed sheet metal.

The new 4.9 mile Chicago subway is the first section of a system of four units planned to include 55 miles of line and to cost 275 million dollars.

get ready with CONE for tomorrow

The Alien Property Custodian has granted licenses to use more than 2,500 of the 45,000 enemy patents that he is holding.

get ready with CONE for tomorrow

Ultra sound waves are being used to break the oxide layer from the surface of sheet aluminum before plating with tin.

get ready with CONE for tomorrow

A new electric motor weighing 7 pounds develops 3 horsepower at 120,000 r.p.m. and reaches full speed in less than a second.

get ready with CONE for tomorrow

One application of a new chemical insecticide to the walls of a room is said to continue to kill flies for three months.

Increased tooling accommodations for the jobs AHEAD



This coaster-brake part, with its eleven different outside diameters, three inside diameters, and its right and left threads, demonstrates the possibilities of the increased tooling facilities of the 8-spindle Conomatic. The steel is X-1315 and the finish of the ball race is good enough for polishing.



CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U. S. A.

Increased Tempo of War Calls For Greater Output of Weapons

Some Schedules Have for Months Been Set Below Desired Levels to Conform to Production Possibilities

Manpower continues to be the chief brake on production of certain badly needed war items. With the increased tempo of war calling for more and more weapons of some categories, production has not kept pace. War expenditures in July dropped \$450 million under June, which in turn, was one per cent under May and three per cent behind schedule. This, of course, represents the overall picture. In some cases, individual items met or exceeded schedules. However the fact that a particular item met its monthly quota does not indicate that production was up to military requirements. Actually, schedules of certain items have for months been set below desired levels in order to conform to production possibilities.

Army officials contend that at the present rate of military expansion in the field, requirements are mounting beyond all previous conceptions, that until Germany is defeated needs will grow steadily, and that by October, production must be boosted by more than 24 per cent over the \$1,852 million June output. This increase applies principally to such items as combat and motor vehicles, scheduled for a boost of approximately 25 per cent over present levels, and ammunition, due to climb 34 per cent. Aircraft calls for the smallest gain—about six per cent.

The regional WPB serving the Michigan and Toledo area reports that a recent survey of 185 behind-schedule plants engaged in crucial war work revealed these factories were short 11,577 needed workers. Apparently, the chief factors, both in hiring and holding employees, are the prevalent belief that the war is nearly over, and the attendant desire to seek the security of employment in industries with an assured postwar future. Despite tightened manpower controls and ceilings on non-war employers, there often is a baffling "evaporation" of workers who quit or are thrown out of employment by cutbacks or cancellations. It is believed that some of these workers—chiefly women—drop out of the employment picture, and others go to small employers not covered by ceilings.

Reflecting the shift of the air war to more B-29 and B-32 bombers and to readjustment of transport planes for longer range and greater capacity, certain aircraft schedules will be cut back

during the next year, according to the War Department. This will result in the release of approximately 20,000 aircraft workers immediately, and of another 100,000 eventually, to other war production and essential civilian jobs. Chief casualty of the action is Higgins Aircraft, Inc., New Orleans, whose contract for C-46 cargo planes has been chopped off before the first plane could be delivered. The Army estimates that the current shortage of C-46's and C-47's will be relieved by the end of this year.

The Curtiss-Wright Corp. plants at St. Louis and Louisville will work toward a schedule of 50 C-46's a month, instead of the 108 previously projected. The Buffalo plant will increase up to 150 a month, gradually tapering off to 100 monthly in mid-1945.

Production of the B-24 at North American Aircraft, Inc., at Dallas is being ended and work from some

Southern California plants is being transferred there to relieve the Southern California labor shortage and to provide work for the released North American workers. Reduction in the output of the B-24, which is being replaced by the much heavier B-29 and B-32, also is scheduled at the Ford Willow Run and the Consolidated Vultee San Diego plants. A few days following the announcement, Maj. Gen. Oliver P. Echols, assistant chief of the Air Staff, in charge of materials, maintenance and distribution, told a senate investigating committee that nearly 20,000 workers will be transferred or laid off at Willow Run before December and that corresponding reductions in personnel will be made at plants supplying parts to Ford. He stated that Willow Run will not be closed, but will be kept going in case of need for additional production. The rate of reduction in schedules at Willow Run and Consolidated will depend on how soon the latter can get into production of the B-32. Detailed arrangements of schedules will be worked out in conferences between the War Department and the North American, Consolidated, and Ford companies.

Another phase of the cutback program provides for transferring some
(Turn to page 60, please)

Shell Program Still Major Influence in the Steel Market

Cold-Finishing Mills Reported to Be Booked to Capacity Well Into 1945. Increasing Demand for Copper

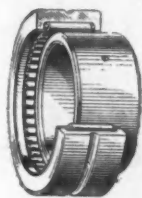
By W. C. Hirsch

While gratefully accepting promises of even so limited a lightening of restrictions on civilian production as have recently come out of Washington, metal producers and consumers are fully cognizant that progress on the European battle fronts will be the determining factor for some time to come. In the steel market the shell program continues to be the outstanding influence, and in the midst of WPB pressure that the Army review its schedule of ordnance requirements, come time and again reminders that the Army's shell program may take all the steel that can be made and may even force a whittling down of tonnages now permitted to be used in civilian goods. So much in the way of fuse bodies and other large calibre shell parts has been added to the list

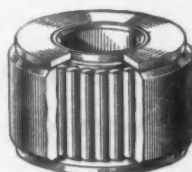
of needed ammunition steel as a result of the type of warfare now being waged in France that cold-finishing mills, thought only a few weeks ago to be nearing more normal conditions, are now reported to be booked to capacity way into next year.

To the need of greatly expanded requirements of heavy artillery ammunition is also attributed a rather tight situation in copper, which metal serves in rotating bands and other essential parts of heavy artillery equipment. In the copper market, however, it is pointed out that, while pressure on certain classes of fabricators may be severe for a time, the Government's stockpiles of copper ingots plus the receipts that may be expected in the next few weeks from South America and the addition of supplies of domestic origin give lit-
(Turn to page 58, please)

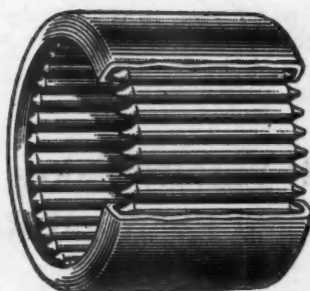
4 Ways Needle Bearings Promote Cost Economies



TYPE NCS



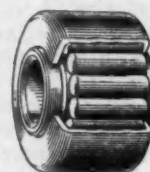
TYPE AT



TYPE DQ



TYPE FDT



TYPE PN

LOWEST COST PER GIVEN LOAD OF ANY ANTI-FRICTION BEARING IS BUT ONE OF THE NEEDLE BEARING'S CONTRIBUTIONS TO COST SAVINGS

One of the surprising features of Torrington Needle Bearings, particularly in the case of the widely used D.C. Type, is their low cost—for they are recognized as the lowest in cost per given load of any anti-friction bearing!

Yet initial cost is only one of several economy features which accrue to users of these modern anti-friction units. Consider, for example, the advantage of their high unit capacity in relation to cost. The smaller size of the Torrington Needle Bearings which may be used results in savings of size, weight and material costs of surrounding members.

This contributes in turn to easier, faster handling of all parts on the production line. But it is the ease and speed with which Torrington Needle Bearings are installed that effect a major saving in time and labor required for assembly. Furthermore, neither the use of snap rings nor staking the bearings in position is required—as once

properly installed Needle Bearings will not shift or creep in the housing.

Efficient lubrication—due to the basic design of these Needle Bearings—eliminates the need for complicated or costly systems for providing ample lubrication. This means simplification of the design and production jobs.

Economies to Aid User

All of these advantages add up to still another important cost consideration—a longer life of trouble-free service—for the product using Torrington Needle Bearings. Reduced costs of servicing, replacement parts and repair, along with lower operating costs due to increased product efficiency are features

your customers will also appreciate.

If you are seeking manufacturing economies and wish to increase your product's efficiency at the same time, you may find the answer in Torrington Needle Bearings. Our Engineering Department will gladly work with you in securing the full advantages of these bearings in your own product planning. Write for further information. A copy of our Needle Bearing Catalog No. 30-A should be in every product engineer's file. Send today for your copy.

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TORRINGTON

NEEDLE BEARINGS

Studebaker's New Direct Dealer Plan For Postwar Automobile Distribution

Higher discounts to direct retail dealers and conversion of qualified former distributors to "Central Dealers" with compensation for certain wholesale functions for a period of one year are cardinal features of the Studebaker Corporation's new direct dealer plan for postwar automobile distribution.

The changeover, decided upon only after discussion with company dealers throughout the country over the past two years, applies only to the United States, according to Paul G. Hoffman, president, who made the announcement.

Under the plan, the factory will take over all wholesaling functions and will establish direct contracts with dealers, most of whom formerly have had contracts with distributors. Company officials state that the change will establish discount schedules and other features of the merchandising program on a basis much more favorable to the dealer. To compensate distributors who qualify as central dealers, and to help bridge the transition period, the plan provides that for one year following resumption of passenger car production such central dealers will receive two-thirds of their former wholesale commission on all cars sold in their former territory, regardless of whether sold through them or purchased directly from the factory. This added compensation is borne directly by the company and in no way affects the dealer's commission.

As provided under the terms of the plan, a central dealer is a former distributor who has had dealers operating under him as of June 30, 1944, and had been a Studebaker passenger car distributor continuously since Dec. 31, 1941, provided that: 1. He has continuously during the above period maintained a place of business as a distributor and provided representation for Studebaker and service to customers in a manner consistent with wartime circumstances and requirements, and satisfactory to the company. 2. There has been no change in principals in the distributorship during the period. 3. The distributor, or major principal, has continued during the period to manager actively the distributorship. (An exception may be made by the company if the distributor or major principal has been serving in the armed forces during the period.)

Only a few former distributors will fail to qualify under these provisions, President Hoffman stated. He pointed out that the company has received numerous letters and telegrams from former distributors declaring the plan to be eminently fair.

Aside from the switch to direct dealerships, the principal feature of the new plan is the scheduled increase in

dealers' discounts on retail sales. Discounts on the Champion line, Studebaker's lowest price car, formerly was a flat 22 per cent. Under proposed new schedules it will be on a sliding scale of 24 to 26 per cent, based on volume. Discounts on the Commander line will be on a sliding scale of 25 to 27 per cent, compared with a maximum 25 per cent previously. Discounts on the President, the company's highest price line, will be established later. Part of the discount is payable after the end of the model year, a plan similar to that which has proved popular with many dealers in the past.

WPB Finally Takes the First Big Step Toward Eventual Reconversion of Industry

WPB has finally taken the first big step toward eventual reconversion of American industry with the issuance of Priorities Regulation 25, effective August 15. This is the so-called "spot authorization" order, which will allow WPB field offices to grant permission to manufacturers to produce hundreds of hitherto prohibited civilian items, provided materials, manpower and facilities not needed for war production are available. However, applications from manufacturers employing more than 250 workers, and those in critical and acute labor areas employing more than 50 and 100 workers, respectively, will be filed in Washington.

To insure the availability of adequate manpower for necessary war work the War Manpower Commission has been given virtual veto power over any increased production of new items, and for this reason reliable WPB officials do not believe that the effects of PR 25 will be felt immediately. However, there is unanimity of opinion that when war contracts are cancelled in large quantities PR 25 will provide the necessary blueprint for orderly conversion to peacetime manufacture.

WPB Chief Donald Nelson in announcing the new plan estimated that war production would be cutback 40 per cent with the fall of Germany, making possible a 30 per cent increase in the production of civilian goods, approximately up to the level of 1939. Until Germany is defeated only relatively simple items and in limited quantities will be made under the new order.

The order conforms to the recent ruling of War Mobilization Director James F. Byrnes, prohibiting increased civilian production in classified areas where it has not been ascertained that labor for such activity is available.

Instructions have been issued to the

Although set up as the intended schedule, the above discounts are contingent upon governmental regulations, competitive discounts and price structures, and other factors beyond the control of the company. Accordingly, application of the increased schedules is subject to the following conditions: 1. Provided there is no material change in the basis and level of discounts on the part of the company's principal competitors or of the industry generally. 2. Provided the company is free to establish list or factory delivered prices on its products without restrictions or limitation by governmental or other action beyond its control. 3. Subject to the company's reservation of the right to change discounts or prices in accordance with the terms and conditions of the franchise and all applicable supplements, addenda or appendices thereto.

WPB field offices that increased civilian production may not be authorized until such time as labor checks have been made and the area representative of WMC has certified in writing that the increased manufacture of civilian goods will not interfere with either local or interregional recruitment of labor for war production.

Since new supplies of materials and components in any appreciable quantity will not be available until war production programs are reduced the immediate production that will result will come mainly from the use of materials and components in idle and excess inventories. It is not expected that production will result in any volume until new supplies are made available as a result of new cutbacks and terminations of war contracts.

Manufacturers desiring to make civilian items should file two forms with their nearest WPB field office. One form (WPB-4000) is an application for authorization and materials to carry on production, while the other (WPB-3820) revised requires information concerning labor.

Applications may be made only to manufacture products covered by WPB orders which specifically permit such application, or for permission to manufacture products which are covered by orders which are listed in Direction 1 to PR 25.

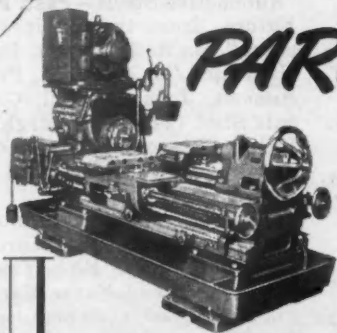
Products of interest to the automotive industry and covered by the following list of orders are subject to the spot authorization procedure. Relief from provisions of the orders will be granted under the spot procedure only to the extent that they prohibit or limit production, other provisions of the orders will remain in effect. However, many of the "L" orders are to be

(Turn to page 102, please)

Do it with a
DUOMATIC

USE MULTIPLE TOOLS TO BEST ADVANTAGE

ON AIRCRAFT PARTS



The DUOMATIC—Lodge and Shipley's full automatic Lathe—has greatly enlarged possibilities of multiple tools in lathe operations.

Shown in the illustration above are seven tools front and seven tools rear performing a complex semi-finishing operation, turning and facing an aircraft engine component. Also shown is a special coolant piping arrangement.

The dual tool slides, front and rear, can be swiveled to cut from any angle. As a result, any combination of turning, and straight or angular "in" or "out" facing cycles are obtainable . . . front and rear, singly or together.

The numerous features on the DUOMATIC are truly a major advance in automatic lathe design. This Lathe operates with equal efficiency and versatility on large or small lots . . . sets new performance records in the production of every type of aircraft part. Write for complete details.

ENGINE • AUTOMATIC • TOOL ROOM • OIL COUNTRY LATHES

THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI 25, OHIO, U. S. A.



Business in Brief

Written by the Guaranty Trust Co.,
New York, Exclusively for AUTO-
MOTIVE AND AVIATION INDUSTRIES

Somewhat broadened fluctuations of general business activity since the mid-year have brought little sustained departure from the average level maintained during the second quarter of 1944. The seasonally adjusted index of *The New York Times* for the week ended Aug. 5 advanced to 144.8, as compared with 140.7 for the preceding week and 141.7 a year ago.

Department store sales, as reported by the Federal Reserve Board, rose from 122 to 132 per cent of the 1935-39 average in the week ended Aug. 12; and the indicated value was 13 per cent above the corresponding sum in 1943. For 1944 to date, the total is 7 per cent greater than the comparable amount last year.

Railway freight loadings during the week ended Aug. 12 totaled 896,172 cars, 0.6 per cent more than the preceding weekly number and 1.0 per cent above the corresponding figure in 1943.

Production of electric power in the same period increased by a smaller amount than the usual seasonal gain; and the total was 2.0 per cent above the output a year ago, as against a similar excess of 3.7 per cent reported a week earlier.

Crude oil production during the week ended Aug. 12 averaged 4,667,300 barrels daily, an all-time peak that is 11,000 barrels more than the average output in August recommended by the Petroleum Administration for War.

Estimated production of soft coal during the week ended Aug. 5 was 12,000,000 net tons, 3.1 per cent less than the preceding weekly figure. For 1944 to date, the indicated output is 8.4 per cent above the comparable amount in 1943.

Engineering construction contracts awarded during the week ended Aug. 17 totaled \$42,335,000, exceeding by 9 per cent the previous four-week moving average, according to *Engineering News-Record*. Contracts so far reported this year show a decline of 47 per cent from the corresponding amount in 1943—the drop in public projects amounting to 53 per cent, as against a recession of 5 per cent in private construction.

The Irving Fisher index of wholesale commodity prices advanced fractionally in the week ended Aug. 11 to an all-time peak, 113.1 per cent of the 1926 average, as against 110.5 a year ago.

Member bank reserves increased \$125,000,000 during the week ended Aug. 16, but excess reserves remained at an estimated total of \$1,000,000,000. Business loans of reporting members declined \$2,000,000 in the preceding week but stood \$299,000,000 above the total a year ago.

Obituary

Harry Scott Wherrett, 68, chairman of the board of directors of the Pittsburgh Plate Glass Company, associated with the organization for more than 53 years, the longest service record of any employe, died on August 13 after a brief illness. He had long been active in business, civic, and philanthropic affairs of the city of Pittsburgh.

William B. Marvin, 64, secretary of Farrel-Birmingham Company, Inc.,

died August 13, after a short illness. He had been connected with the company for 39 years, having entered the employ of Birmingham Iron Foundry in 1905.

Asthor E. Jacobson, 50, divisional controller for the Chevrolet Div. of General Motors Corp., died at Detroit August 14. A Chevrolet employe since 1919, he had served as resident controller of plants at Janesville, Wis., St. Louis, and Flint, becoming divisional controller in 1933.

Morton S. Robertson, 46, former manager of the Hupp Motor Car Corp. plant at Detroit, died suddenly at his home near Port Huron, Mich., recently. Mr. Robertson also was a former executive of the Parker Wolverine Co. of Detroit.

Shelby M. Jett, 55, of Akron, Ohio, secretary, head of the legal department and a member of the board of directors of the B. F. Goodrich company since 1927, died suddenly aboard a commercial transport plane, just before arriving at the Cleveland Airport, August 9.



AWARDS

Names of winners of Army-Navy "E" awards in or allied with the automotive and aviation industries announced since the Aug. 15 issue of *Automotive and Aviation Industries* went to press:

CHAMPION SPARK PLUG COMPANY, Ceramic Division, Detroit, Mich.

CONSOLIDATED ENGINEERING CORPORATION, Pasadena, Cal.

E. I. DU PONT DE NEMOURS & COMPANY, Newburgh Plant, Newburgh, N. Y.

THE FLEXIBLE COMPANY, Londonville, Ohio.

GRAY COMPANY, Graco Plant, Minneapolis, Minn.

MAYNARD ELECTRIC STEEL CASTING COMPANY, Emille Plant, Bristol, Pa.

NICHOLSON FILE COMPANY, G. & H. Barnett Division, Philadelphia, Pa.

SCOVILL MANUFACTURING COMPANY, Hamilton Beach Company, Racine, Wis.

UNION CARBIDE & CARBON COMPANY, Autopoint Company, Chicago, Ill.

UNITED STATES INDUSTRIAL DIAMOND CORP., Adamant Tool Co. Division, Bloomfield, N. J.

WALES STRIPPIT CORPORATION, North Tonawanda, N. Y.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, Cleveland Works, Lighting Division, Cleveland, O.

"E" Star Awards

for continued meritorious services on the production front have been awarded to the following firms:

ACE MANUFACTURING CORPORATION, Philadelphia, Pa.

BROWN INSTRUMENT COMPANY, Philadelphia, Pa.

W. H. NICHOLS & SONS, Waltham, Mass.

The three plants of Farrel-Birmingham Co., Inc., at Ansonia and Derby, Conn., and Buffalo, N. Y., have been awarded the Maritime "M" Pennant and the Victory Fleet Flag.

SAE Tractor Meeting to Be Held at Milwaukee

An engineering preview of the design of postwar tractors, the steels of which they will be made, and the fuels they will use will be provided at the SAE National Tractor Meeting scheduled for September 13 and 14 at Milwaukee, Wis. The meeting is sponsored by the SAE Tractor and Farm Machinery Engineering Activity, with the cooperation of the SAE Milwaukee Section. General chairman is Estbern A. Petersen, of Massey Harris Co., Racine, Wis. The tentative program follows:

Wednesday morning, Sept. 13, Gear Teeth Session, with Elmer McCormick, of John Deere Tractor Co., Waterloo, Iowa, as chairman. "Welcome to Milwaukee," T. L. Swansen, of Allis Chalmers Mfg. Co., Milwaukee, chairman, SAE Milwaukee Section. "Be Vigilant—and Mum!", Major Albert J. Stowe, G. S. C., representing Major General Clayton Bissell, Assistant Chief of Staff, G-2, U. S. Army, Washington, D. C. "The Design of Gear Teeth," Fred Bohle, of Illinois Tool Co., Chicago, Ill. Prepared discussion, F. L. Knowles, Gleason Works, Rochester, N. Y.

Wednesday afternoon, Fuels Session, with L. B. Sperry, of International Harvester Co., Chicago, as chairman. "Fuel Requirements for Tractors," A. T. Colwell, of Thompson Products, Inc., Cleveland, Ohio. Prepared discussions, D. P. Barnard, of Standard Oil Co. (Indiana), Chicago, and Earl Ginn, Continental Motors Corp., Muskegon, Mich.

Thursday morning, Sept. 14, Fuel Injection Session, with J. M. Davies, of Caterpillar Tractor Co., Peoria, Ill., as chairman. "Application of Gasoline Injection to Tractor Engines," H. O. Hill, of American Bosch Corp., Springfield, Mass. Prepared discussions, R. K. Weldy, of Ex-Cello Corp., Detroit, Mich., and A. W. Pope, Jr., of Waukesha Motors Co., Waukesha, Wis. Thursday afternoon, Steels Session, with Walter F. Strehlow, of Allis Chalmers Mfg. Co., Milwaukee, as chairman. "Automotive Steels—Past, Present, and Future, from the Engineering Viewpoint," H. B. Knowlton, International Harvester Co., Chicago. Prepared discussions, John Mitchell, Carnegie-Illinois Steel Corp., Pittsburgh, Pa.; G. C. Riegel, Caterpillar Tractor Co., Peoria; and W. H. Naegely, J. I. Case Co., Racine.

Thursday evening, Annual Tractor Dinner, with O. R. Schoenrock, of J. I. Case Co., Racine, SAE Vice President for Tractor and Farm Machinery Engineering, as chairman, and C. E. Frudden, of Allis Chalmers Mfg. Co., Milwaukee, as toastmaster. "Tractors of Tomorrow," SAE President W. S. James, of The Studebaker Corp., South Bend, Ind. "Agriculture's Post-War Opportunities," Wheeler McMillan, editor in chief, *The Farm Journal*, Philadelphia, Pa.

These Easy-to-Fabricate Stainless Steels give your Designer a *Free Hand!*

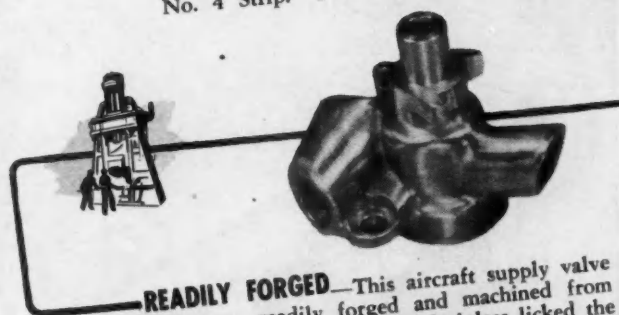


WHEN you start with Carpenter Stainless Steels in planning your new or redesigned products, your designer can take full advantage of their diversified properties and easy-working qualities. Carpenter pioneering has developed a wide variety of Stainless Steels. Today, they are meeting the critical demands of the aircraft, chemical processing, special instrument, and many other industries producing war equipment. There is a Carpenter Stainless grade for almost any job that may come your way.

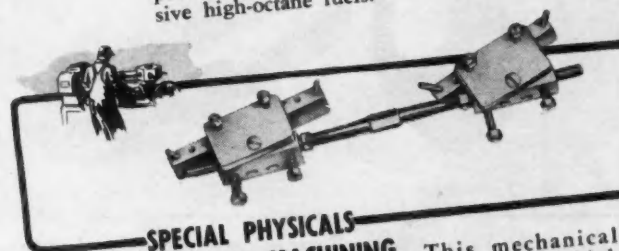
Your nearby Carpenter representative can be particularly helpful to you in planning the use of Stainless Steels in your present or postwar products. Make use of his diversified Stainless experience to build longer, trouble-free life into your products and speed production in your shop.



EASILY FORMED—The smooth, rounded protective bead on this aircraft hose clamp was rolled the hard way—*along the grain of the metal*. No difficulty was experienced when the manufacturer went to ductile Carpenter Stainless No. 4 Strip. Production was increased, too.



READILY FORGED—This aircraft supply valve body was readily forged and machined from Carpenter Stainless No. 8. Stainless licked the problem of valve "sticking"—caused by corrosive high-octane fuels.



SPECIAL PHYSICALS and FREE MACHINING—This mechanical splint required accurate machining and high finish, plus resistance to corrosion, high strength and special hardness qualities. The combination of Carpenter Stainless grades No. 4 and No. 5 met all these requirements and helped reduce costs on finished parts.

The Carpenter Steel Company • 103 W. Bern Street • Reading, Pa.

Carpenter STAINLESS STEELS

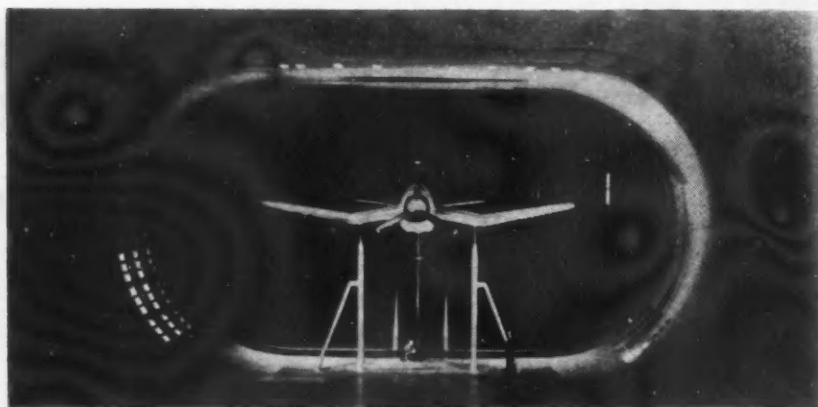


BRANCHES AT
Chicago, Cleveland, Detroit, Hartford,
St. Louis, Indianapolis, New York, Philadelphia

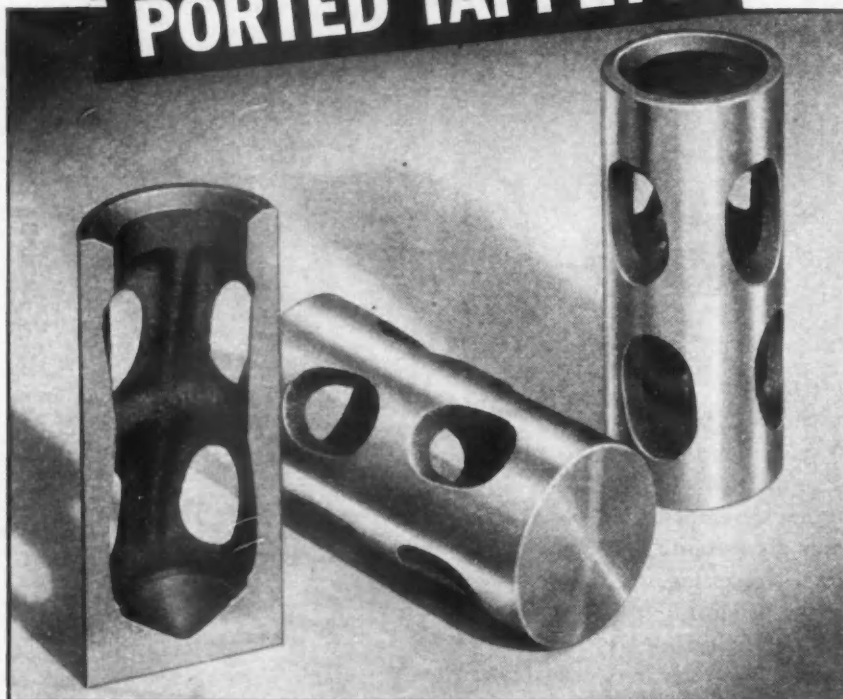


Another "World's Largest"

Covering eight acres of ground, what is said to be the world's largest wind tunnel for full-scale airplane testing has been completed at Moffett Field, Cal., by Pittsburgh-Des Moines Steel Company. The structure is 868 ft in length and has a ceiling height of 180 ft. Its width at one end is 399 ft, and at the other, 353 ft. The new unit is box-shaped, with exterior bracing, leaving the interior unobstructed for air flow.



"CHICAGO" PORTED TAPPETS



"Chicago" Ported Valve Tappets are being used extensively in diesel and gasoline engine fields. Over years of service and under severe conditions these tappets have proved that they can "take it" . . . In specifying valve tappets—there are many advantages to be gained by insisting upon "Chicago" Ported Valve Tappets. These quality products are made from a special grade of alloy cast iron, assuring uniform "clear chill" depth at the cam face . . . The "porting" feature of these tappets has a definite advantage in providing lubrication of tappet guide holes . . . Exact inspection operations guarantee machining and grinding to the highest standards of quality . . . "Chicago" Ported Valve Tappets are made in a wide range of sizes to meet our customers' individual specifications.



THE CHICAGO SCREW CO.

ESTABLISHED 1872

1026 SO. HOMAN AVENUE CHICAGO 24, ILL.

British Ministry Supplies Translation

In the article, "Cylinder Arrangement for 4000 Hp Engines," which was published in two installments in the June 15 and July 1 issues of *AUTOMOTIVE AND AVIATION INDUSTRIES*, reference was omitted as to the source of the translation of the German article from the *Luftwissen* periodical. Credit for supplying the translation is due the British Ministry of Aircraft Production, which has been exceptionally cooperative in that respect.

PERSONALS

Wayne Martin, formerly assistant materials engineer with Sperry Gyroscope Co., Inc., has been appointed sales engineer for The National Smelting Co., Cleveland.

The appointment of Harold W. Schaefer as assistant manager of the newly-formed Radio Receiver Div. of the Westinghouse Electric & Mfg. Co. has been announced.

Karl A. Roesch, former sales manager of the Cleveland Branch of the White Motor Co. has been made Cleveland Branch Manager.

Arthur M. Morgan, vice president in charge of sales of Latrobe Electric Steel Co. has been elected a director of that company.

L. W. Fox has returned to the Akron offices of the Firestone Tire and Rubber Co. to act as manager of the Field Engineering Div. of the Tire Development Dept.

Cone Automatic Machine Co., Windsor, Vt., has announced that Lt. Col. V. A. Armstrong has joined their organization. He was formerly connected with the Machine Tool Section of the Army & Navy Munitions Board, Washington.

Niles-Bement-Pond Co. has announced the election of Alexander S. Keller as vice president.

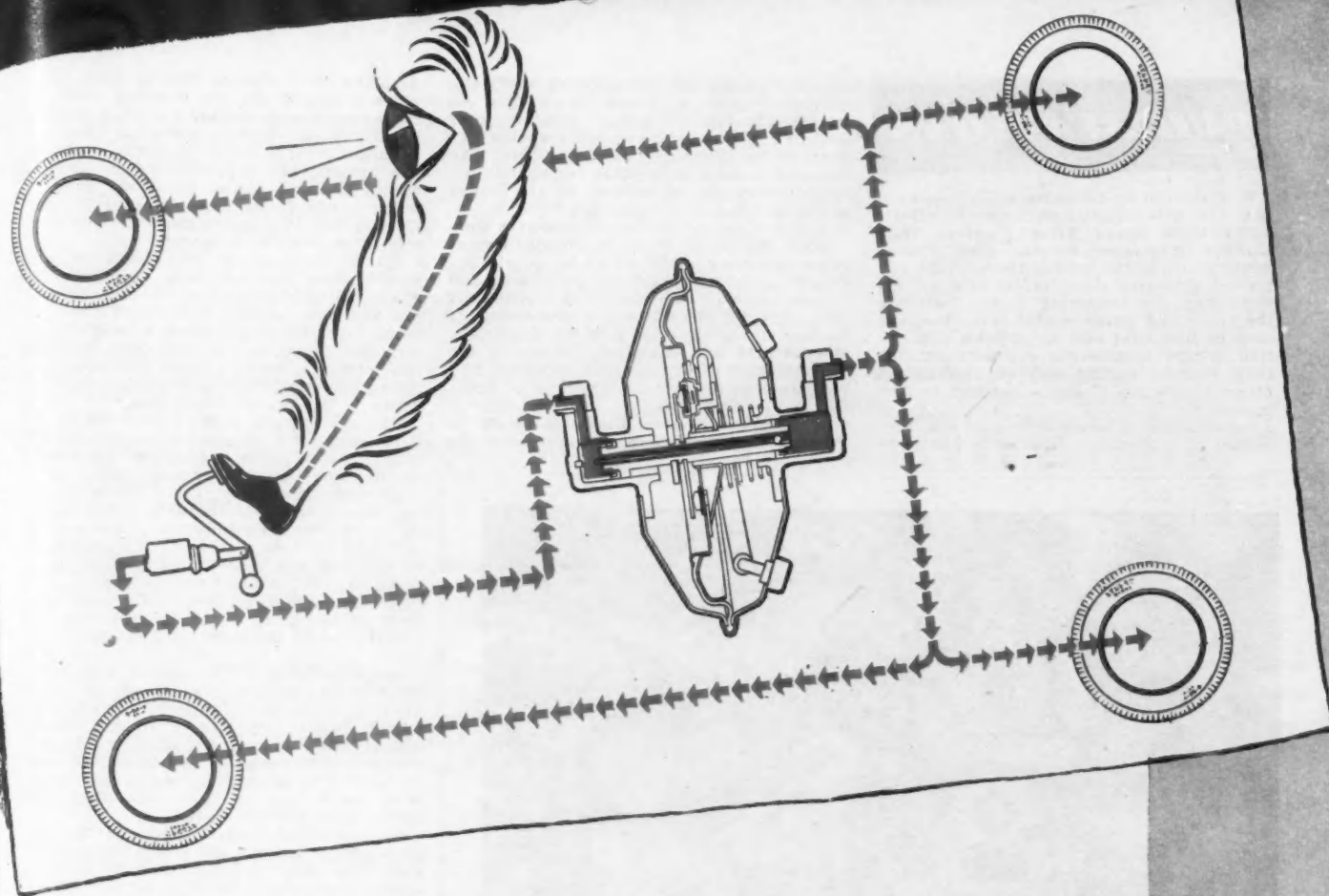
The appointment of Fred R. Cooper to the executive staff of Warren City Mfg. Co. has been announced. He was formerly assistant to Joseph W. Frazer, president of Willys-Overland.

James L. Straight has been appointed manager of the Los Angeles office of the Aircraft Manufacturers Council and its parent organization, the Aeronautical Chamber of Commerce.

M. M. Clark has joined Climax Molybdenum Co. as metallurgical engineer, Ohio District, with headquarters at Canton.

R. A. Hartman has joined Kropp Forge Co. and Kropp Forge Aviation Co. as superintendent of the machine shop. He was formerly

(Turn to page 168, please)



IMAGINE-YOUR BRAKES WITH A *Feather touch* STOP!

We mean you 14,850 Engineers; 8,590 Production Men; the 5,065 Administrative Officers of some 2,500 manufacturers and other executives who are an integral part of the automotive industry. YOU will be interested!

Suppose on your car or truck you attained a Feather-Touch Stop. Suppose a 50 pound foot pressure was transmitted into 1,000 pounds of smooth, instantaneous braking power — compensate for "eye-to-pedal" reaction lag and "leg fatigue"

yet still build into your hydraulic system a feather-touch, quick, safe stop. Suppose it would reduce accidents, check costly repairs and delivery delays due to the lack of split second brake action.

If you are in any phase of "transportation" — engineering, production, management, sales or maintenance, does it not seem reasonable that you would want the complete story? Space here does not permit, but your inquiry will bring complete details.

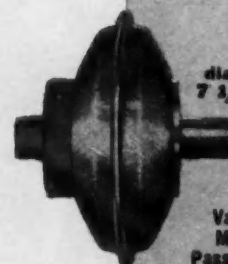
VACDRAULIC

THE BRAKE POWER BOOSTER

EMPIRE ELECTRIC BRAKE CO. • 118 SOUTH 14TH STREET, NEWARK 7, N. J.

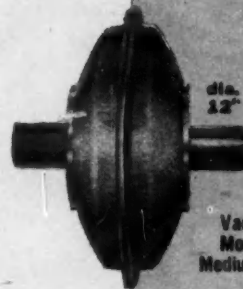
EMPIRE PRODUCTS INCLUDE:

MAGDRAULIC • VACDRAULIC • POWER STEERING • RHEOSTATS
ELECTRIC BRAKES POWER BRAKING DEVICES



dia.
7 3/4"

Vacdraulic
Model 50
Passenger Cars
and Light Trucks



dia.
12"

Vacdraulic
Model 100
Medium Trucks



Vacdraulic
Model 310
Heavy
Duty
Trucks

length 22"

PUBLICATIONS

E. I. duPont de Nemours & Co. has published a new manual on explosive rivets titled **High Speed Blind Riveting With DuPont Explosive Rivets**. The manual contains complete information on the improved explosive rivet, tables of sizes, instructions for preparing work, installing the rivets and other helpful data. Postwar uses of this rivet and its possible application in the automotive, refrigerating, air conditioning, heating and ventilating and other industries is also discussed in the manual.*

Information of interest to any one concerned with precision grinding is contained

in the 12-page booklet **Grinding With Oil**, published by D. A. Stuart Oil Co. The use of straight oils for thread grinding, gear grinding and other precision grinding operations is discussed and illustrated. An unusual feature is a chart comparing the wheel markings of several of the larger grinding wheel manufacturers.*

A new Catalog Section on **Karbate Corrosion Resistant Heat Exchange Equipment** has been published by National Carbon Co., Inc. It contains several charts and tables covering the heat conductivity and the physical and chemical properties of carbon, graphite and Karbate materials. Illustrations and drawings indicating the versatility of these materials in design and execution of an extensive variety of heating and cooling units are also included.*

A 32-page booklet, **Curtis Aircraft in Combat and Commerce**, published by the

Airplane Div., Curtiss-Wright Corp., provides a simple key for ordering prints of more than 110 photographs of some 12 types of aircraft. Up-to-date releasable data, and in many cases, round-the-clock views of the aircraft are supplemented by combat photographs of planes of World War II, such as the Curtiss Helldiver dive bomber, Curtiss C-46 Commando transport and Curtiss P-40 Warhawk fighter.*

A new catalog and data book on self-locking nuts has just been issued by the Elastic Stop Nut Corp. of America. It covers the hex, anchor and clinch types of nuts. Size, material, class fit, axial load strength based on pull-test data, military requirements, weight, finish and other information on ESNA self-locking nuts is given in handy, tabulated form.*

Chrysler Corp.'s Amplex Div. has issued a 168-page book designed to provide American industry with a complete knowledge of the wide variety of powder metal bearings and parts now being produced by Chrysler under its Oillite trade name. Many up-to-the-minute engineering developments and general facts concerning the production of bearings and machine parts from metal powders are contained in the book. A 23-page engineering section covers such subjects as specifications, design features and practice, shaft clearance, load rating charts, etc.*

We Also Serve is the name of an attractive booklet published by the Spicer Mfg. Corp. It contains many pictures and illustrations and describes the part which Spicer products are playing on the battlefronts of the world. A section of the book is devoted to Spicer facilities for the large-scale production of new and improved power transmission units.*

An attractive booklet, covering the use of plastic materials for modern industrial production has been published by Plaskon Div., Libby-Owens-Ford Glass Co. It is well illustrated with photographs of a wide variety of products molded from the several different types of plaskon materials. A section of the book is devoted to Plaskon Resin

(Turn to page 170, please)



**Forgings—laboratory controlled—strength, toughness
—minimum weight that stands up under unpredictable loads.**

WYMAN-GORDON
WORCESTER, MASS. · HARVEY, ILL. · DETROIT, MICH.

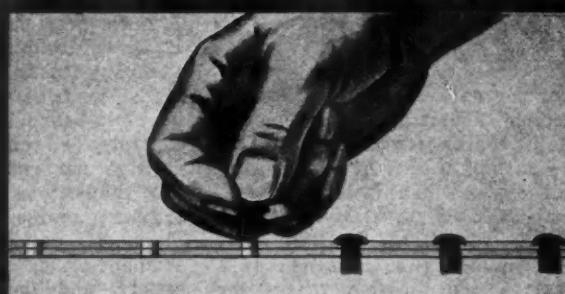
1944 Monthly Production of Trucks and Truck Tractors*

| LIGHT | | | | |
|-----------------------------|----------------|----------------|----------------|--|
| 1944 | Civilian | Military | Total | |
| January..... | 21,479 | 21,479 | 21,479 | |
| February..... | 21,095 | 21,095 | 21,095 | |
| March..... | 21,081 | 21,081 | 21,081 | |
| April..... | 19,481 | 19,481 | 19,481 | |
| May..... | 19,338 | 19,338 | 19,338 | |
| June..... | 20,830 | 20,830 | 20,830 | |
| Total—6 Months | 123,304 | 123,304 | 123,304 | |
| MEDIUM | | | | |
| 1944 | Civilian | Military | Total | |
| January..... | 1,965 | 12,812 | 14,777 | |
| February..... | 1,798 | 9,940 | 11,738 | |
| March..... | 3,317 | 8,404 | 11,721 | |
| April..... | 6,245 | 6,542 | 12,787 | |
| May..... | 7,310 | 7,012 | 14,322 | |
| June..... | 9,322 | 6,820 | 16,142 | |
| Total—6 Months | 29,977 | 51,330 | 81,307 | |
| HEAVY | | | | |
| 1944 | Civilian | Military | Total | |
| January..... | 543 | 21,784 | 22,327 | |
| February..... | 968 | 21,867 | 22,835 | |
| March..... | 1,305 | 22,351 | 23,656 | |
| April..... | 1,910 | 21,443 | 23,353 | |
| May..... | 1,988 | 21,096 | 23,084 | |
| June..... | 2,559 | 21,809 | 24,368 | |
| Total—6 Months | 9,273 | 130,350 | 139,623 | |
| TOTAL—ALL WEIGHTS | | | | |
| 1944 | Civilian | Military | Total | |
| January..... | 2,528 | 56,075 | 58,603 | |
| February..... | 2,766 | 52,902 | 55,668 | |
| March..... | 4,622 | 51,836 | 56,458 | |
| April..... | 8,155 | 47,466 | 55,621 | |
| May..... | 9,298 | 47,646 | 56,944 | |
| June..... | 11,881 | 49,259 | 61,140 | |
| Total—6 Months | 39,250 | 305,184 | 344,434 | |

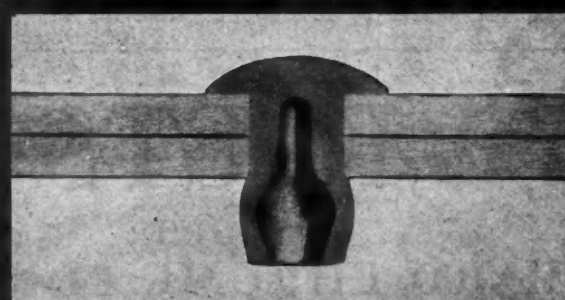
*—Automotive Division—War Production Board.

NOW IMPROVED EXPLOSIVE RIVETS

do an even better
job of blind riveting



1 They may be inserted in drilled holes more easily and more quickly . . . to speed up this operation.



2 When set the Improved Rivet completely fills the hole . . . makes a strong, tight-fitting joint.

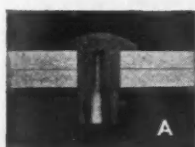
COMPARE the Improved Du Pont Explosive Rivet (A) with the original design (B). Note that the cavity of the Improved Rivet is extended the full length of the shank.

When the Rivet is expanded, not only is a perfect, barrel-shaped head formed on the blind side (C), but the entire shank of the Improved Rivet also expands slightly (D). This completely fills the hole . . . locks the Rivet firmly in place and results in a tight joint with high shear and tensile strength—even when holes are slightly oversize. Close-tolerance drilling to provide push-fit holes is eliminated, and many

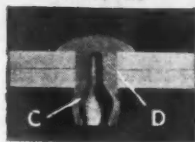
more rivets per minute can be inserted.

Improved Du Pont Explosive Rivets are available in both Modified Brazier and Countersunk types of 5/32" and 3/16" nominal diameters.

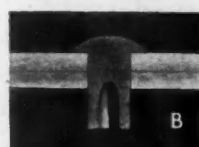
For complete information send for the NEW manual illustrated below. It is packed with helpful information and data on the Improved Rivet. Also discusses the post war use of Explosive Rivets, and possible application in the automotive, refrigeration, air conditioning and other industries. E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, 5494 Nemours Bldg., Wilmington, Delaware.



IMPROVED



C D



ORIGINAL



► Fill in and mail the coupon at the right for your copy of this useful manual.

Send for your copy of this NEW manual

Kindly forward my copy of "High Speed Blind Riveting with Du Pont Explosive Rivets."

Name _____ Title _____

Company _____

Street _____

City _____ State _____



DU PONT IMPROVED EXPLOSIVE RIVETS

The only one-piece blind rivet

Shell Program

(Continued from page 48)

the cause for apprehension that a serious copper shortage is developing. Donald M. Nelson compared the other day the surplus stocks of copper with those of steel, which latter are estimated at 3,000,000 tons, and said the former were very light. It all simmers down to what may be regarded as a safe reserve and to what extent the demand for copper, because of the heavy artillery program, will increase in the next few months.

Charging that the Government was furthering the danger of future un-

employment by refusing to remove controls over magnesium, Dr. Willard H. Dow, president of the Dow Chemical Company, in an open letter to Donald M. Nelson, chairman of the War Production Board, has asked that these controls be removed forthwith. "As matters now stand," wrote Dr. Dow, "the industry is entirely capable in the ordinary course of production of supplying all possible needs of the Government either for domestic use or for export, and the stockpile is of such proportions as to give ample insurance against any kind of shortage." Magnesium capacity, as of September 1, is expected to be reduced 50 per cent from the war peak. Further produc-

tion cutbacks in aluminum are said to be contemplated with a view to relieving acute manpower shortages.

It is learned that the Army Air Transport Command has lately been flying sizable tonnages of Chinese tin in Curtis C-46 planes to India for re-shipment to the United States. Ever since the Japanese took over the Burma road, Chinese tin and wolfram have been coming to the United States, part of the way airborne. The movement now appears to have assumed more important proportions. The Bolivians are still making every possible effort to induce the U. S. Government's tin smelting and marketing agency to grant them a higher price.

FACTS

ABOUT HARD CHROME PLATING

ONE of the principle advantages of chromium is its ability to resist corrosion.

However, it is sometimes true that chrome does not offer proper protection to the base metal itself due to its porosity. But, wherever this inadequate protection occurs, it is generally evident that the coating is too thin or the actual plating itself has been at fault.

It is obvious therefore, that a proper plating procedure cannot be overemphasized.

For example, the ability of Chromium to resist corrosion certainly could not be ignored as a protective coating for precision gage blocks . . . measuring accuracies in the millionths of an inch.

But the correct process of applying chromium to precision gages presented a major problem.

It was in 1937 that Elmer Ellstrom of the Dearborn Gage Company began to actively experiment with the practicality of finishing the gaging surface of Dearborn Gages with corrosion resistant chromium.

After exhaustive experiments the impossible was accomplished—Chrome was actually applied to precision gage blocks and without loss of accuracy in any manner. This first major improvement in the manufacture of gage blocks brought to industry standards of measurements that would retain their true accuracies longer than any hard steel gage made; that is why Ellstrom-made gage blocks will last 2 to 5 times longer by actual test.

★ This is number 2 in a series of articles by the Dearborn Gage Company on chromium plating.

DEARBORN GAGE CO. 22037 BEECH STREET
DEARBORN, MICHIGAN



Originators of Chromium Plated Gage Blocks



P-61 Black Widow

This new night fighter is 49 ft in length and has a span of 66 ft. It is powered by two 2,000 hp Pratt & Whitney engines. Armament consists of .50-cal. machine guns and 20-mm cannon.

CALENDAR

Conventions and Meetings

| | |
|--|-------------|
| American Chemical Society, New York City | Sept. 11-15 |
| SAE Natl. Tractor Meeting, Milwaukee | Sept. 13-15 |
| SAE Natl. Aircraft Eng. & Production Mtg., Los Angeles | Oct. 5-7 |
| American Society of Toal Engineers, Syracuse, N. Y. | Oct. 12-14 |
| American Society for Metals, Cleveland | Oct. 16-20 |
| Natl. Machine Tool Builders Assoc., Annual Meeting, Hot Springs, Va. | Oct. 19-20 |
| SAE Natl. Fuels & Lubricants Mtg., Tulsa | Nov. 9-10 |
| Natl. Standard Parts Assoc., Annual Fall Conference, Chicago | Nov. 9-11 |
| American Chemical Society Natl. Chemical Exp., Chicago | Nov. 15-19 |
| SAE Natl. Air Cargo Mtg., Chicago | Dec. 4-6 |
| Natl. Aviation Trades Assoc., St. Louis | Dec. 6-7-8 |
| SAE Annual Meeting, Detroit | Jan. 8-12 |
| Automotive Electric Assoc., Chicago | Feb. 5-12 |

How many machine tool operations help to make him

the safest flyer in the world . . .

America spends more time, more money, more effort to protect the life of a flyer than any other country in the world . . . He is the unexpendable.

Into a single engine of his plane go as many as 84,000 individual manufacturing operations . . . to accuracies as fine as four-millionths of an inch.

And of all the machine tools in use by the aviation industry, none is more basic or more vital than the internal grinding machine.

Bryant engineers have helped the men of government and of industry to plan the most desperate and gigantic production program of all time . . . and they can help those same men in planning today for the peace that must be won after the war is won!

We invite you to send for a Bryant man today.



BRYANT

CHUCKING GRINDER CO.
SPRINGFIELD, VERMONT, U. S. A.





If you make temperature responsive devices for any purpose, then some one of the 35 different types of Chace Thermostatic Bimetals will exactly meet your needs for the actuating element. Each type of Chace Thermostatic Bimetal is especially engineered to meet specific conditions . . . each will produce known action at a predetermined temperature . . . all are very economical . . . and always dependable.

Let Chace help you select the most efficient type of bimetal for your control.

W.M. CHACE Co.
Manufacturers of
 Thermostatic Bimetals and Special Alloys
 1610 BEARD AVE • DETROIT 9, MICH.

Greater Output of Weapons

(Continued from page 48)

airplane sub-contract work from Akron to Republic Aviation Corp., Evansville, Ind., where the P-47 is being manufactured. This action will release many workers who can be put in tire plants at Akron to help relieve the critical heavy tire situation.

Fisher Body Div. of General Motors Corp. is building a new model M-4 tank, equipped with a 76 mm gun, Diesel engine, and wet ammunition stowage. The tank is being produced at the Flint and Grand Blanc, Mich., plants. During the past 2½ years, Fisher Body Div. has turned out more than 11,000 medium tanks and tank destroyers embodying 22 different production and development models.

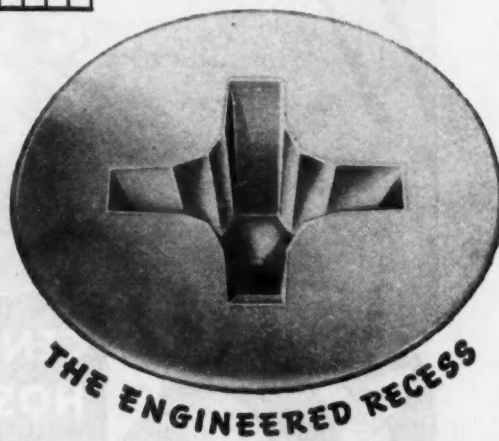
Also, the War Department has revealed that the General Sherman tank used in the Battle of France is armed with a 105-mm Howitzer, the largest gun ever carried by a medium tank. In addition it mounts two .30 cal. machine guns, a .50 cal. machine gun, a mortar, a .45 cal. sub-machine gun, hand grenades, and smoke bombs. Chrysler has produced more than 15,000 General Shermans to date.

More than 236,000 square feet of floor space has been converted to manufacture of special axles and transmissions by Reo Motors, Inc., Lansing, Mich. A major move to speed production of military vehicles, the program is part of a large ordnance program to provide component parts to major truck manufacturers, including Reo. Production was underway four months after conversion started, with volume production of transmissions attained in June, and axles coming off the lines in July. Front power-driven axles and tandem rear axles are being produced. Both of the tandem axles are powered.

Nash Kelvinator Corp. for several months has been in secret production of motors for heavy caliber rocket shells used on invasion barges. The motor is composed of a long fuel chamber, a jet known as a "discharge venturi," directional guiding vanes, and electrically discharged percussion firing contacts. Nash currently is preparing to get into production of Sikorsky R-6 helicopters.

Although the truck program in general is lagging, Dodge Div. of Chrysler Corp. is 1000 trucks ahead of its schedule. Dodge started building experimental trucks for the Army in 1934 and to date has built 340,000 trucks for the United States and the other United Nations. It produced 100,000 a year in 1942 and 1943 in addition to an undisclosed number of commercial trucks. WPB has scheduled production of 56,705 essential civilian trucks in the first quarter of 1945, compared with 93,562 during all of 1944. The quota calls for 40,000 medium, 13,366 light heavy, and 3339 heavy trucks. The quota for the last quarter of 1944 is 41,063 units.

WHEN THIS → DREW A BLANK THE BOSS TORE HIS HAIR UNTIL SOMEONE WISED HIM UP TO THIS → → THE RECESSED HEAD SCREW THAT UPS DRIVING SPEED AS MUCH AS 50% IT'S PHILLIPS



Stymied because you've just got to boost assembly department output and you can't hire more workers to do it? No need to be!

You can boost output another way — by switching to Phillips Recessed Head Screws. They will increase driving speed as much as 50 percent. They have done it for hundreds of plants!

With Phillips Recessed Head Screws, your workers encounter

none of the troubles that cause slow driving. Spiral and power driving can be used where speed tools have always been impractical. And, the work becomes so much easier that assemblers can maintain a fast pace throughout a shift.

Switch to Phillips Recessed Head Screws. You'll find they'll give you faster driving, easier driving, greatly increased output. You'll also find they *cost less to use!*



PHILLIPS *Recessed Head* SCREWS

WOOD SCREWS · MACHINE SCREWS · SELF-TAPPING SCREWS · STOVE BOLTS

TO MAKE WARTIME QUOTAS AND PEACETIME PROFITS

Faster Starting: Driver point automatically centers in the Phillips Recess... fits snugly. Fumbling, wobbly starts, slant driving are eliminated. Work is made trouble-proof for green hands.

Faster Driving: Spiral and power driving are made practical. Driver won't slip from recess to spoil material or injure worker. (Average time saving is 50%.)

Easier Driving: Turning power is fully utilized. Workers maintain speed without tiring.

Better Fastening: Screws are set-up uniformly tight, without burring or breaking of screw heads. The job is stronger, and the ornamental recess adds to appearance.



IDENTIFY IT!



Center corners of Phillips Recess are rounded... NOT square.



bottom of Phillips Recess is nearly flat... NOT tapered to a sharp point.

24 SOURCES

American Screw Co., Providence, R. I.
Atlantic Screw Works, Hartford, Conn.
The Bristol Co., Waterbury, Conn.
Central Screw Co., Chicago, Ill.
Chandler Products Corp., Cleveland, Ohio
Continental Screw Co., New Bedford, Mass.
The Corbin Screw Corp., New Britain, Conn.
General Screw Mfg. Co., Chicago, Ill.

The H. M. Harper Co., Chicago, Ill.
International Screw Co., Detroit, Mich.
The Lantson & Sessions Co., Cleveland, Ohio
Manufacturers Screw Products, Chicago, Ill.
Milford Rivet and Machine Co., Milford, Conn.
The National Screw & Mfg. Co., Cleveland, Ohio
New England Screw Co., Keene, N. H.
Parker-Kalon Corp., New York, N. Y.

Pawtucket Screw Co., Pawtucket, R. I.
Phooli Manufacturing Co., Chicago, Ill.
Reading Screw Co., Norristown, Pa.
Russell Burdall & Ward Bolt & Nut Co., Port Chester, N. Y.
Sevill Manufacturing Co., Waterville, Conn.
Shakeproof Inc., Chicago, Ill.
The Southington Hardware Mfg. Co., Southington, Conn.
Wolverine Bolt Co., Detroit, Mich.

Proctor IV Built Chiefly of Wood and Plastics

(Continued from page 25)

two seats side by side with dual control, one for a pupil pilot and the other for an instructor, no structural alterations being required. The separate flying control unit simplifies production, whether one or two sets of flying controls are to be fitted originally. The Proctor has a wide and deep cabin and low engine cowling line. The pilot is seated well forward and has an excep-

tionally good view over the nose and the leading edge of the wing.

Every part of the airframe can be reached after completion; the structure can be broken down completely for quantity and dispersed production. The fuselage (Fig. 2) may be termed a box-monocoque construction, with sides, bottom and superstructure built as separate units. Hinged doors are

fitted to each side allowing easy access to the cabin from the wing. These doors can be readily jettisoned, in case of emergency, by pulling down levers mounted in the roof.

Only the tips and the leading edges of the main and center wing sections have plywood skin covering; aft of the front spar fabric covering alone is used, apart from a plywood walkway at each side of the fuselage to give access to the cabin. Wooden split trailing edge flaps, operated by a hand lever in the cockpit, are fitted from the ailerons to the side of the fuselage. The folding-wings are hinged on the rear spar joint fittings, with locking mechanism operating on the front spar joint. When the wings are spread, a positive and foolproof device makes sure that the bottom front locking pins are in position before the top pins can be inserted. The gap fairings cannot be assembled until the top pins are in position.

The tailplane is a complete cantilever comprising two wooden box spars, ribs and plywood covering. The whole structure is fabric-covered and is secured to the fuselage by two bolts at



CENTRAL UNIVERSAL HOSE CLAMPS

IN

Action!

• Army and Navy combat vehicles, farm and road-building machinery, diesel and gasoline engines, and all types of radiator hose are equipped and serviced with Central Universal Hose Clamps.

It's the clamp-power of Central Universal Hose Clamps that keeps the Army "Ducks" watertight and in action on land and water!

Made of extra-heavy rolled steel, the Universal is powerful enough to withstand abnormal pressure, stress and vibration. It is rustproof, leakproof, self-locking, 100% universal, and easy to use in hard-to-get-at places.

Standard for all service needs, it can be quickly installed or removed without disconnecting the line.



CENTRAL EQUIPMENT CO.

900 SO. WABASH AVE., CHICAGO 5, ILL.



A SINGLE LENGTH UNIVERSAL CLAMP FITS HUNDREDS OF DIAMETER SIZES

Proctor IV Specifications

| | |
|---|------------------------------|
| Engine |210 bhp |
| Wing—Span |39 ft 6 in. |
| —Aspect ratio |7.72 |
| —Area |202 sq ft |
| —Loading |17.3 psf |
| Power loading |16.8 lb per bhp |
| Length |28 ft 2 in. |
| Tare weight (with full equipment) |2370 lb |
| Disposal load |1130 lb |
| Max all-up weight |3500 lb |
| Top speed (sea level) |160 mph |
| Cruising speed (sea level) |148 mph |
| Landing speed (flaps down) |55 mph |
| Range |490 miles |
| Rate of climb (sea level) |700 fpm |
| Time to reach 5000 ft |9 min |
| Ceiling |14,000 ft |
| Take-off (no wind) |320 yd |
| Take-off to clear 50 ft obstruction (no wind) |630 yd |
| Fuel consumption (140 mph at 3000 ft) |14-15 miles per Imp gal |
| Propeller |7 ft diam |

the front spar and one bolt at the rear spar on the center line. The elevator has a wooden box spar, spruce and ply ribs, and is diagonally braced. A trimming tab is fitted to each side, operated from an irreversible unit on the spar. The fin is similar in construction to the tailplane, while the rudder is similar to the elevator and has a horn balance at the top which houses a mass balanced weight. A trimming tab is fitted at the trailing edge, with a similar control to that of the elevator tabs.

A long-travel undercarriage unit is located under each end of the center section of the wing, giving a track of 9 ft 9 in. Each unit consists of a cantilever compression leg incorporating steel springs and a hydraulic recoil damper. The tail wheel is attached to a cast aluminum rocker arm

SIMPLICITY . . .

The simplicity of the Vickers Hydraulic Power Steering System is evident from the typical application shown below. The System consists primarily of an engine-driven hydraulic pump, a pressure overload safety valve and the booster unit.

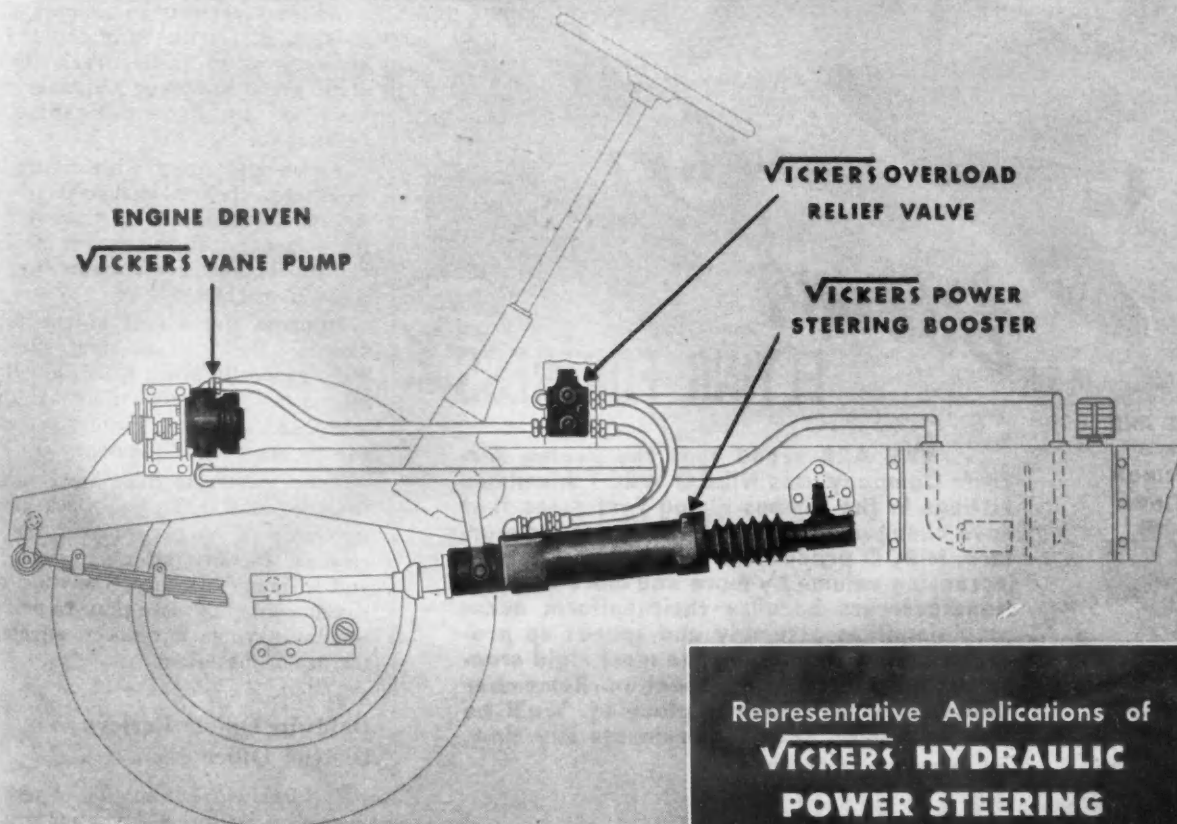
The booster is essentially a double acting hydraulic jack with integral control valve which instantaneously responds to the slightest steering wheel movement . . . directing oil under pressure to the booster cylinder and producing linear movement of the attached drag link. The steering effort is not transmitted through the steering gear.

Providing effortless, positive and shockless steering of even the heaviest vehicles, the Vickers Hydraulic Power Steering System has been in use under the most adverse operating conditions for the last 14 years. It assures greater driver

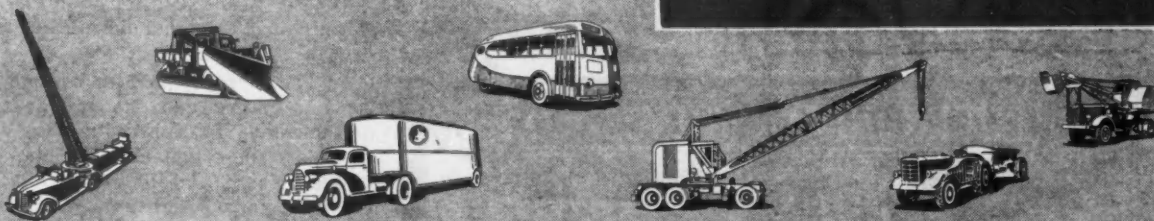
Another Important Advantage of **VICKERS HYDRAULIC POWER STEERING**

efficiency by reducing fatigue to a minimum . . . it is easily applied to existing chassis designs . . . it provides automatic overload protection for both steering linkage and hydraulic system . . . it is automatically lubricated. Ask for new Bulletin 44-30 describing all the advantages of Vickers Hydraulic Power Steering.

VICKERS Incorporated • 1428 OAKMAN BLVD. • DETROIT 32, MICHIGAN
Application Engineering Offices: CHICAGO • CLEVELAND • DETROIT • LOS ANGELES • NEWARK • PHILADELPHIA
ROCHESTER • ROCKFORD • TULSA • WORCESTER



Representative Applications of **VICKERS HYDRAULIC POWER STEERING**



hinged from the bottom of the stern-post; it is completely rotatable and self-centralizing. Shock absorbing is by means of a spring, recoil being damped by a fabric brake band.

The engine, driving a de Havilland constant-speed propeller, is mounted in rubber anti-vibration blocks on tubular steel bearers. A vacuum pump is fitted for the operation of blind-flying instruments and a large generator is driven through a flexible coupling shaft. A 20 Imp. gal fuel tank is located in each outer wing section, at the root end between the spars, while the oil tank, of 3.8 Imp. gal capacity, is mounted in the leading edge of the

center section on the port side. An oil cooler is fitted at the inboard end of the tank and fared into the center section, with an outlet flap adjustable on the ground. The engine can be started from the cockpit.

The cabin accommodates the largest type of radio sets installed in operational aircraft. Inter-communication telephone equipment is provided for each member of the crew, allowing the instructor to talk to either the radio pupil or the pilot. A fixed aerial and a trailing aerial cover the whole range of wave-lengths needed for radio training. The direction-finding loop aerial on top of the cabin can be used for in-

struction in flying on a wireless beam or checking position by taking bearings on two or more radio stations whose positions are known. For training in visual signalling to ships or troops on the ground there is an Aldis lamp stowed beside the rear seat. The Proctor is completely equipped for night flying. When used as a four-seater communication aircraft the single rear seat is replaced by two, so placed as to give ample leg-room and still leave space for light baggage.

Convair Tooling Dock Speeds Production

(Continued from page 21)

Then the finished fixture is removed from the dock by means of the overhead crane.

The primary advantage of the Master Tooling Dock is that it provides automatic coordination for various three-dimensional assembly fixtures with accuracy and reliability heretofore possible only in positioning second-dimensional detail assembly fixtures. Three dimensional assembly fixtures can now be positioned without recourse to free-hand measurements on the part of tool-makers, and with such rapidity and economy as to justify even the construction of prototype airplanes on the basis of an efficient manufacturing breakdown.

Strict conformity with lofting data facilitates the establishment of parts interchangeability from the start, and many months can be saved in initiating the production program for any large piece of machinery.

Prior to the advent of the Master Tooling Dock, toolmaking tolerances were generally about 0.005 in. Now a tolerance of 0.002 in. can be maintained with ease, and even slighter tolerances can be observed if necessary.

Time studies to date have revealed that the Master Tooling Dock saves a minimum of 50 per cent of the time required for any job it can accomplish, and in many instances the time saved has amounted to more than 75 per cent. Similar savings have been effected in the use of materials.

Baldwin Opens Eastern District Office

The Baldwin Locomotive Works has opened an Eastern District office in the Broad Street Station Building, Philadelphia, Pa., to handle sales of all Baldwin Divisions.

The territory will include portions of New Jersey and the entire states of Pennsylvania, Kentucky, West Virginia, Delaware, Maryland, Virginia, Tennessee, North Carolina, South Carolina, Mississippi, Alabama, Georgia, and Florida.



CAST AND
WROT
ALUMINUM
FITTINGS



NIBCO

WE ARE proud that the Boeing Aircraft Company uses NIBCO WROT Aluminum Fittings in the famous Flying Fortresses that have changed the whole strategy of air warfare. NIBCO products are being used in ever increasing volume by more and more aircraft manufacturers because their uniform accuracy simplifies assembly and speeds up production. They're meeting the most rigid standards and the stiffest inspection. Remember NIBCO in your Post-war planning. We'll be glad to discuss your requirements any time.

WROT Fittings



NORTHERN INDIANA BRASS CO.

ELKHART, INDIANA

VALVES AND FITTINGS SINCE 1904



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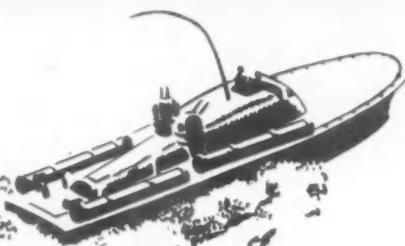


NO. 9 OF A SERIES "HIGHLIGHTS OF WORLD WAR II" PRESENTED BY TUBE TURNS (INC.) LOUISVILLE, KY. SEE OTHER SIDE

BY JAMES M. SESSIONS

Underwater Exploit

TRADITION . . . killed in action



The *Seawolf* patrolled on the ocean side was damaged by one of the war's most powerful explosives. It crippled submarine armor on enemy ships near Lissa's west coast.



"It can't be done" . . . and never was . . . until Tube Turns successfully forged a cylinder head and barrel unit in approximately normal forging tolerances above rough machined dimensions. Strength? These forgings take the terrific punishment meted out by the speediest ships afloat — P.T.'s! Weight? About 55% LESS than older methods!

Perhaps you have some part, or future development, that demands upset forging quality but seems too "difficult." It may be of steel, aluminum, or other light alloys. We welcome tough assignments, and offer aggressive engineering and research cooperation in every phase of forging — product planning, die design, forging technique, heat treating, metallurgy and testing . . . coupled with extensive modern facilities for precision production in big volume. TUBE TURNS (Inc.), Louisville 1, Ky.

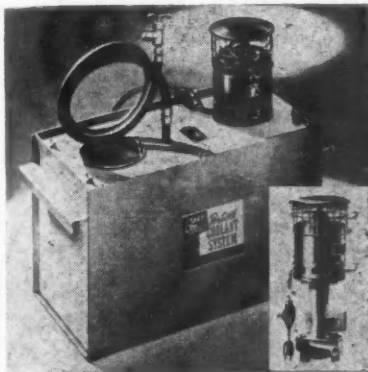
TUBE TURNS *Forgings for Industry*

New Production Equipment

(Continued from page 40)

A NEW model in the line of Gray-Mills coolant systems, the Model 1130, is said to be particularly suited for the application of coolants to grinders, cut-off saws, milling machines, and such operations as fine abrasive cutting and honing. Flow is adjustable from a trickle to a full stream.

The 1130 unit is easily portable. It is ready for immediate plug-in operation and fits snugly under a machine or in any out-of-the-way place. Forced-



Gray-Mills model 1130 coolant system and 1100 centrifugal pump

settling baffle plates are built into the tank to reduce circulation of solids. Heart of the G-M 1130 is the new Gray-Mills 1100 centrifugal pump with a capacity of 1200 gph (water) at 0 head; 360 gph at 5 ft head. Motor is 1/15 hp.

The G-M 1100 Pump is also designed for in-built coolant systems and as a general purpose pump for sumps, etc. Mounting bracket permits either vertical or horizontal attachment, or the unit may rest on its base of three legs.

LINCOLN PARK INDUSTRIES, INC., Lincoln Park, Mich., have added to their line of gages and precision tools a new product—Carblox cemented-carbide gage blocks in the Hoke type.

As a series of wear blocks to be



Carblox gage blocks

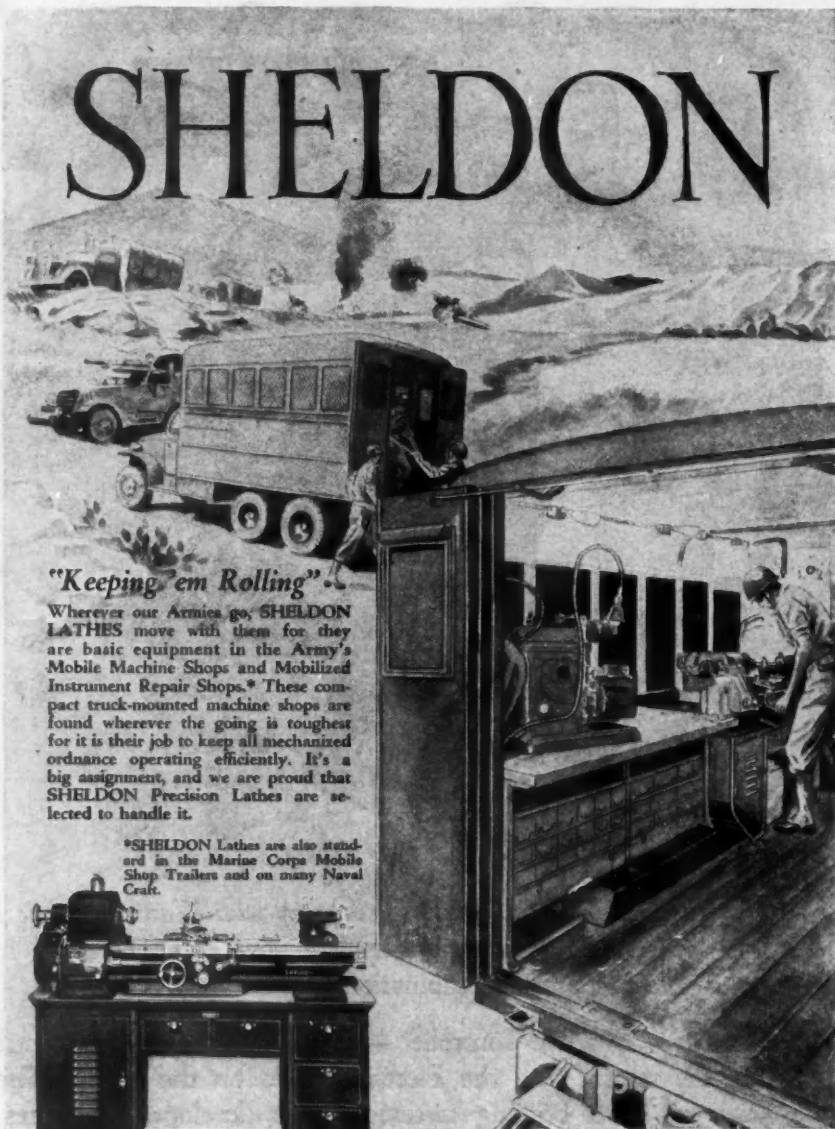
used on the ends of a gage block build-up, Carblox provide the means to reduce the wear error in gage block use, supplement and increase the useful, accurate life of present gage block sets. They act as protective anvils, preventing wear on the less wear-resistant steel blocks. They can, of course, also be used as individual blocks.

Hoke type Carblox are .950 in. square with .260 in. holes and are available in either "A" accuracy

(.000004 in.) or "B" accuracy (.000008 in.) in sets of two .050 in. or .100 in., in sets of four (two each of .050 in. and .100 in.) and in sets of fourteen varied sizes. This set of fourteen, supplemented with the standard 81-piece set of gage blocks, provide build-ups of practically any desired range. Special size Hoke type Carblox can be furnished.

AIRCO No. 90-A electrode, an improved version of the smaller sizes of Airco No. 90 electrode, has just been introduced by Air Reduction Sales Co., New York, N. Y. This electrode is (Turn to page 70, please)

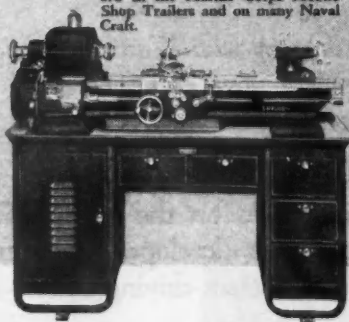
SHELDON



"Keeping 'em Rolling"

Wherever our Armies go, SHELDON LATHES move with them for they are basic equipment in the Army's Mobile Machine Shops and Mobilized Instrument Repair Shops.* These compact truck-mounted machine shops are found wherever the going is toughest for it is their job to keep all mechanized ordnance operating efficiently. It's a big assignment, and we are proud that SHELDON Precision Lathes are selected to handle it.

*SHELDON Lathes are also standard in the Marine Corps Mobile Shop Trailers and on many Naval Craft.



Write for
Catalog



SHELDON MACHINE CO., Inc.
4220 N. KNOX AVE., CHICAGO 41, U.S.A.

Announcing NEW WARNER ELECTRIC *Now* INGENIOUS WARNER CONTROLLER



PERFECTED — ready for delivery with Warner Electric Brake Systems — or for quick change-over on tractor-trailers now equipped with hydraulic brake and Warner Electric Brake Combinations.

The new Warner Controller — simple and compact — synchronizes the hydraulic brakes on the tractor with the Electric Brakes on the trailer. The tractor's regular foot pedal operates both braking systems. This development creates smooth, foot-touch tractor-trailer braking under all conditions — eases driving strain — assures greater safety.

The new Warner Controller has the same basic simplicity of Warner Electric Brakes themselves — world famous for easy installation, and efficient, trouble-free performance. Get the benefits of this great advancement now. See your Warner dealer about changing over your present equipment. Specify Warner Electric Brakes on all future trailer purchases.

BRAKE ADVANCEMENT!

Synchronizes Tractor Hydraulic Brakes and Trailer Electric Brakes so Foot Pedal Operates them TOGETHER

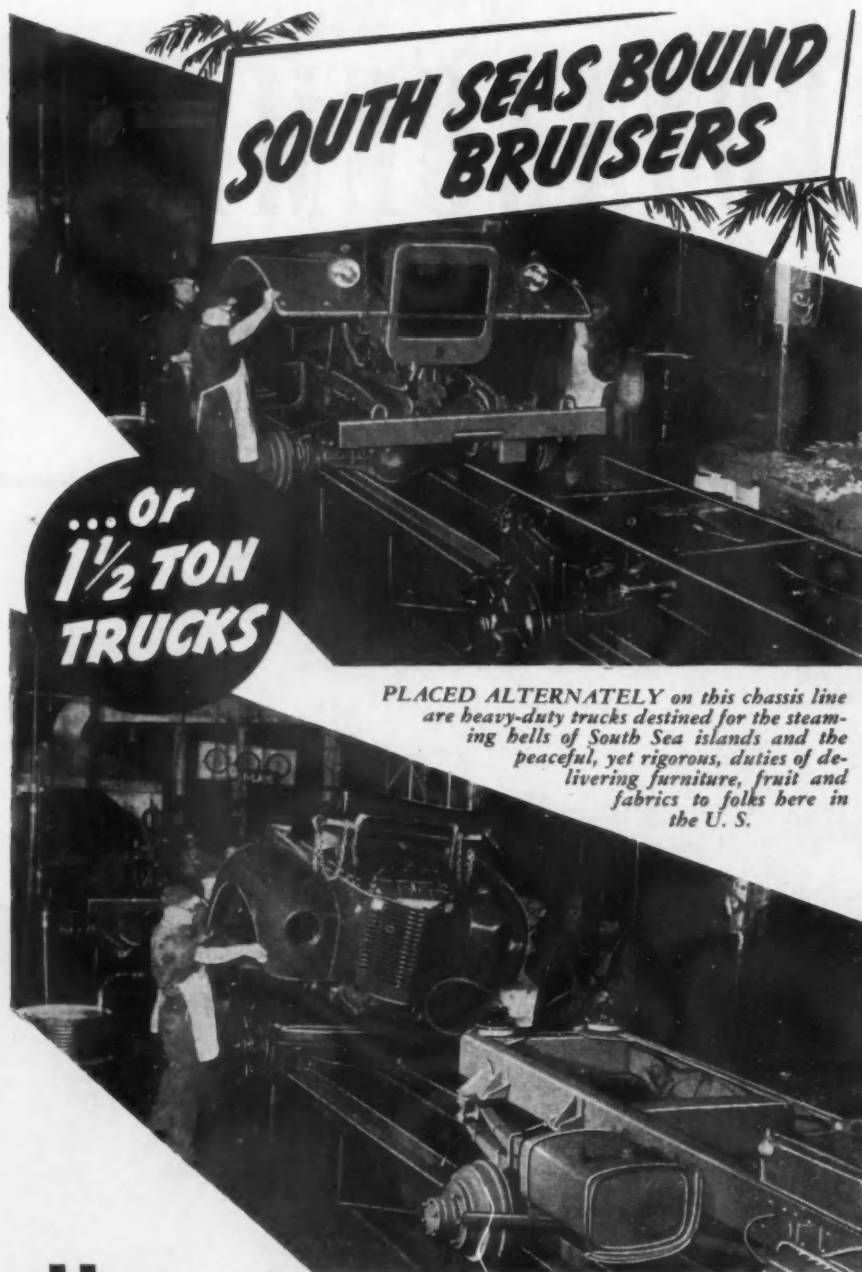
Controller is easily and quickly fitted into the hydraulic brake line.

Only a few flexible wires. Nothing to freeze or chatter . . . No complicated mechanisms.

FOOT PEDAL PRESSURE
CONTROLS BRAKES ON
Both TRACTOR AND
TRAILER

WARNER

ELECTRIC BRAKES



SOUTH SEAS BOUND BRUISERS

**...or
1½ TON
TRUCKS**

*PLACED ALTERNATELY on this chassis line
are heavy-duty trucks destined for the steam-
ing bells of South Sea islands and the
peaceful, yet rigorous, duties of de-
livering furniture, fruit and
fabrics to folks here in
the U. S.*

Handled More Efficiently On An A-F Engineered Conveyor System

DESIGNED to move 1½ ton trucks at the most efficient production speed, this A-F Conveyor System took on the indoor transportation of heavy duty army trucks for the U. S. Naval Forces placed alternately with trucks for domestic use. It is now engineered to allow for 8- and 9-ton trucks . . . If your plant has a product handling problem, why not let A-F Engineered Conveyors help you solve it? Write today.



THE ALVEY-FERGUSON COMPANY

Offices in Principal Cities 25 DISNEY STREET, CINCINNATI 9, OHIO

Affiliated Corporation

The Alvey-Ferguson Company of California

P. O. Box 396, Vernon Branch, Los Angeles 11, California



Alvey-Ferguson

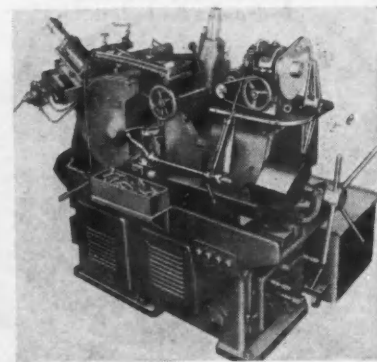
METAL PRODUCTS CLEANING & FINISHING EQUIPMENT

especially designed for welding light-gage chrome-moly and similar steels used in aircraft. It is made to a new coating formula that is said to provide notably smoother arc operation, better appearance of deposits, stronger arc action, reduced slag interference, and excellent operation at high currents without deterioration of coating at stub end.

The electrode is available in all three sizes for light gage welding—1/16 in., 5/64 in., and 3/32 in. diameters. It is equally efficient for both a-c and d-c operation, straight or reversed polarity. The electrode meets the requirements of U. S. Army Air Corps Specification 10286-B, Type 1, Grade 2E, and conforms to A.W.S. and A.S.T.M. Specifications for Classification E 6013.

HECKETHORN Manufacturing & Supply Co., Littleton, Colo., has designed a set of attachments, called "Hecomatic," for use in connection with a Cincinnati centerless grinder for the production of 20-mm projectiles.

Hecomatic consists of three units—



Centerless grinder with Hecomatic attachments

the magazine, the power unit, and the electric solenoid ejector. It does, mechanically, all the operations which a man would do in hand feeding, grinding, and ejecting. A large portion of the cycle is used for grinding; only a small portion for loading and ejecting.

PREVIOUSLY available only through an AA-1 priority, Johansson gages, manufactured by the Ford Motor Company, may now be distributed to the trade without restriction providing sales do not hamper future priority orders.

A new case is provided for certain sets of gages. By re-designing the recesses, each individual block can be removed by applying a slight pressure which causes the block to rise on end. It then can be lifted out easily, and in position for immediate use. This new design also eliminates the possibility of sticking to the recesses when block surface become soiled.

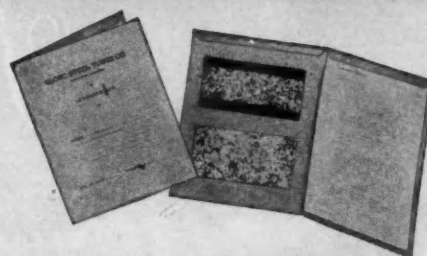
Another contribution to accurate gaging has been introduced in chrome-
(Turn to page 72, please)



***Complete* FACILITIES FOR RESEARCH AND TEST ON TUBING PROBLEMS . . .**

Day in and day out, in a spacious building with complete and modern facilities, Globe chemists and metallurgists conduct research on tubing problems. Testing and inspection of Globe Steel Tubes are regular routine. Special problems of customers are studied, too, and physical and chemical tests, spectrographic and microscopic examinations are made, to select the correct analyses for each customer's particular needs. The Globe technical staff is available at the mill or in the field, for technical service on tubing problems.

5007



A typical special report, prepared by the Globe laboratory and technical staff.

- ★ Boiler and Pressure Tubes
- ★ Condenser and Heat Exchanger Tubes
- ★ Stainless Tubes (Seamless)



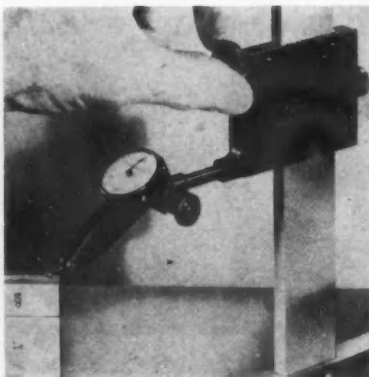
- ★ Mechanical Tubing
- ★ Gloweld Tubes (Welded Stainless)
- ★ Globeiron Tubes (Seamless Pure Iron)

GLOBE STEEL
Tubes

GLOBE STEEL TUBES CO. *Milwaukee 4,
Wisconsin, U. S. A.*

plated Johansson Gage Blocks. This special chrome plating process also makes it possible to restore worn sets of blocks to their original accuracy.

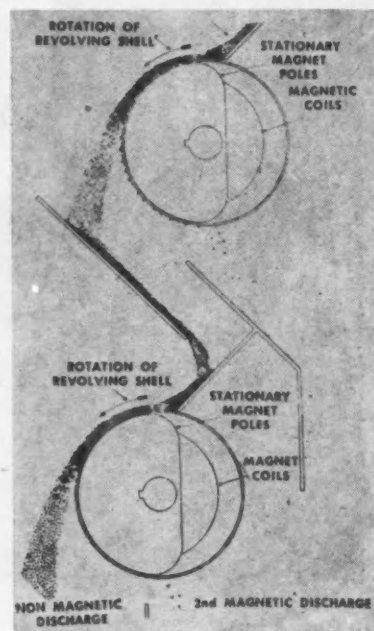
FEDERAL PRODUCTS CORPORATION, Providence, R. I., offers a new fine adjustment height gage, Model 1492. The gage consist of a Federal Testmaster indicator, a fine adjustment bracket, and an 18-in. stand. The fine adjustment bracket may be set anywhere on the upright and the Testmaster indicator point raised or lowered 0.030 in. by means of the fine adjustment screw. A slide brake keeps the fine ad-



Federal height gage model 1492

justment bracket from dropping when unclamped.

THE Dings Magnetic Separator Company, Milwaukee, Wis., has announced an improved double drum, high intensity magnetic separator for separating ferrous and non-ferrous scrap. The principle of operation is indicated in the accompanying diagram. New features of the machine include high temperature windings on the coils, which are capable of withstanding hot aluminum chips. Outboard bearings are used on the drum shafts, permitting easy inspection and removal if necessary. Either drum can be removed

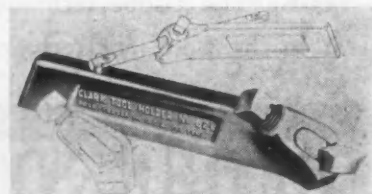


Dings magnetic separator

without dismantling the entire separator.

All bearings are the dust-sealed, anti-friction type. A pressure feed lubrication system has been incorporated in the unit which supplies lubrication to all vital points. Capacity of the 24 in. width model is approximately 5,000 lbs. of aluminum borings per hour.

AN ADJUSTABLE tool holder for use in lathes, shapers, and planers is being offered by the Robert H. Clark Company, Beverly Hills, Cal. The Clark principle of adjustability makes possible the use of any of four or more sizes of tool bits in the same holder (Turn to page 74, please)



Clark tool holder

JEWELS OF

Precision
MILLIONTHS OF AN INCH

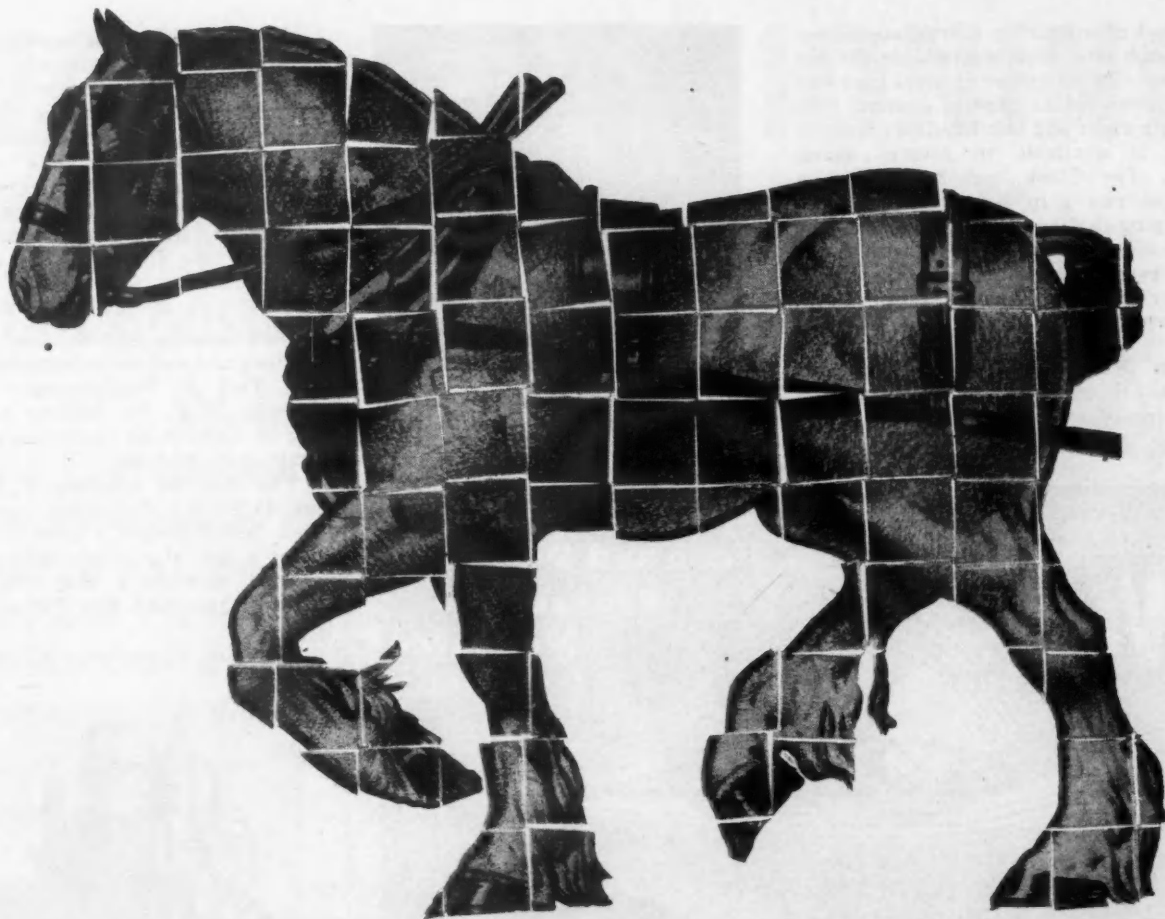
BALLS OF STEEL, BRASS,
BRONZE, MONEL METAL,
AND STAINLESS STEEL

THE ASSOCIATION OF MANUFACTURERS

BALLS - BALL BEARINGS - ROLLER BEARINGS

HOOVER

BALL AND BEARING COMPANY, ANN ARBOR, MICHIGAN



James Watt's **horse** has been divided into 100 parts

For centuries "One Horsepower" had meant simply the work that one horse could do.

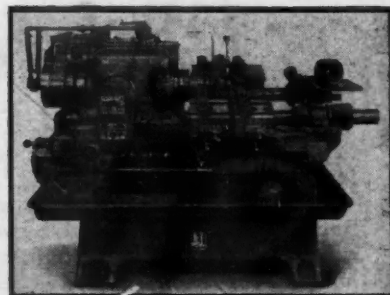
Then, 175 years ago, James Watt gave the term its modern meaning when he borrowed a husky dray horse from an obliging brewer and put the animal to the test. By means of tackles and weights, and some paper work, he determined that the horse could raise 1000 pounds at the rate of 33 feet per minute. So we got our familiar equation, 1 horsepower = 33,000 foot pounds per minute.

This was a lot of power—ideal for draught work—useless for the smaller, more tedious tasks such as operating a razor, a needle, a fan or an egg beater. Only a visionary would have thought of this.

But, the advent and development of electrical power condensed Watt's horse and divided him into a hundred tiny fractions. Power far greater than his is now packed into less than a cubic foot, and fractions of him fit neatly into the palm of your hand.

Tomorrow, these tiny, useful fractions of horsepower will take over more and more of our trivial, but tedious, work. For, today, men with ideas have the help of the makers of modern, fast, accurate machine tools.

For over a century, Jones & Lamson engineers have been helping our most progressive manufacturers to put their newest ideas into profitable production. This accumulation of experience and knowledge is at your service today.



A Jones & Lamson Fay Automatic Lathe tooled to machine the frame for a small electric motor. Fay Automatic Lathes are used extensively to machine parts for all kinds of domestic appliances, that add to our comfort and lighten our work.

JONES & LAMSON
MACHINE COMPANY
Springfield, Vermont, U.S. A.

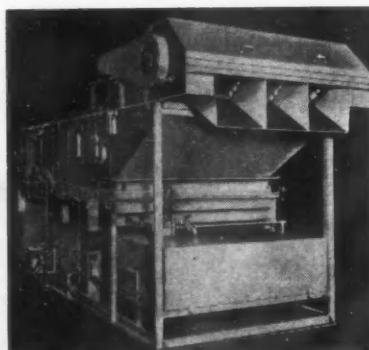


Profit-producing Machine Tools

Manufacturers of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.

instead of requiring a separate holder for each size. Models available are the 15 deg. sloping cutter channel type and the horizontal or parallel channel type in both right and left hand offset. Each type is available in several shank sizes. The Clark tool holder has a special vise grip jaw with a unique clamping action for holding the bit vertically and horizontally with pressure evenly distributed over the entire holder channel, thus preventing tool bit breakage.

THE Detrex Degreaser shown here has three divisions which permit cleaning of assorted types and sizes of



Metal Cleaning Machine Designed for Postwar Use

parts. Design of the machine was so coordinated to enable the manufacturer, whose business was in small automotive accessories, to install the machine for production cleaning of ammunition clips. No change whatsoever in construction of this degreaser will be necessary when the time for conversion arrives. Detrex Degreasers are made by the Detrex Corporation, Detroit, Mich.

This special-purpose machine was designed and manufactured by Snyder Tool & Engineering Company, Detroit, Mich., for drilling and reaming 24 holes in an aluminum alloy aircraft cylinder head.

The machine consists of a Snyder standard 20-V-16 drilling machine column installed upon a special base and using a special multiple head mounting bracket, carrying a 48-spindle multiple drilling head and two 24-hoe bushing plates.

Clamping is manual. All operations



Now **The TRIMOUNT** *Dynamic Pressure* **GAUGE**

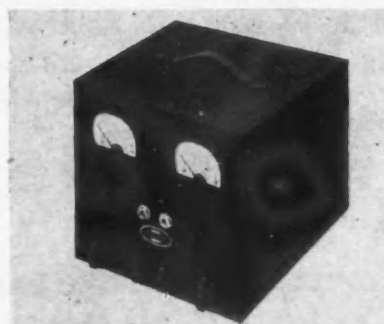
The Series "N" Trimount Dynamic Pressure Gauges offer outstanding advantages over old style, conventional instruments for measurement of air foil pressure distribution and boundary layers, manifold, blower rim, fuel system, air scoop and hydraulic system pressures, and other measurements requiring accurate, sensitive, static and dynamic interpretations.

The Series "N" Gauges are of the differential type with ranges from 0 to 1000 lbs., and frequency response from 0 to 500 C.P.S. They can be used with existing type of carrier amplifying equipment. Other series offer ranges from 0 to 3500 lbs. Complete data and specifications available on request.



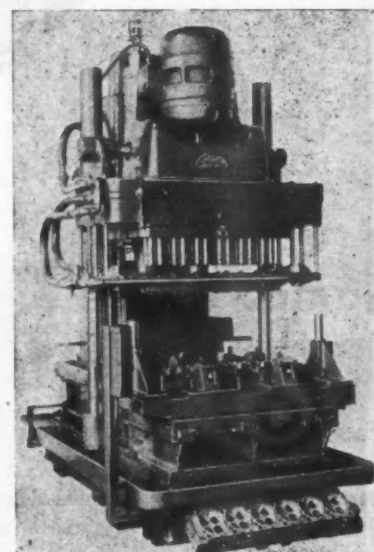
Above—Trimount Series "N" Dynamic Pressure Gauge for ranges of 0 to 1000 lbs. Unit measures $3\frac{1}{2}$ inches long x 2 inches diameter.

Below—Trimount carrier system comprising power supply and amplifier channels in one convenient case, light, portable, dependable.



TRIMOUNT *Instrument* **COMPANY**

37 WEST VAN BUREN STREET • CHICAGO 5, ILLINOIS



Snyder drilling machine

—drilling, moving from drilling to reaming position, reaming and returning to loading position—are automatic after the cycle starter button is pressed.

In case of tool trouble, an emergency return button retracts the tools from the work and the fixture automatically returns to loading position, from either drilling or reaming operation.

WICKES BROTHERS, Saginaw, Mich., have released information on a new design in their line of heavy duty lathes. The illustration shows a front view of the machine tooled for the rough turning operation in the production of 14-in. and 16-in. high explosive shells.

This lathe is powered with a 75-hp motor, has alloy steel gears throughout, and anti-friction bearings on all
(Turn to page 78, please)

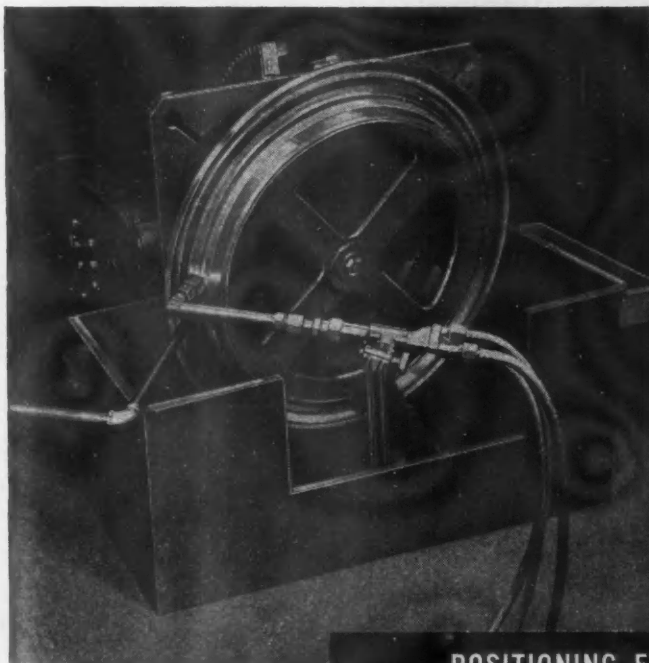
WORK POSITIONING

The Means to Cutting Costs and Boosting Production

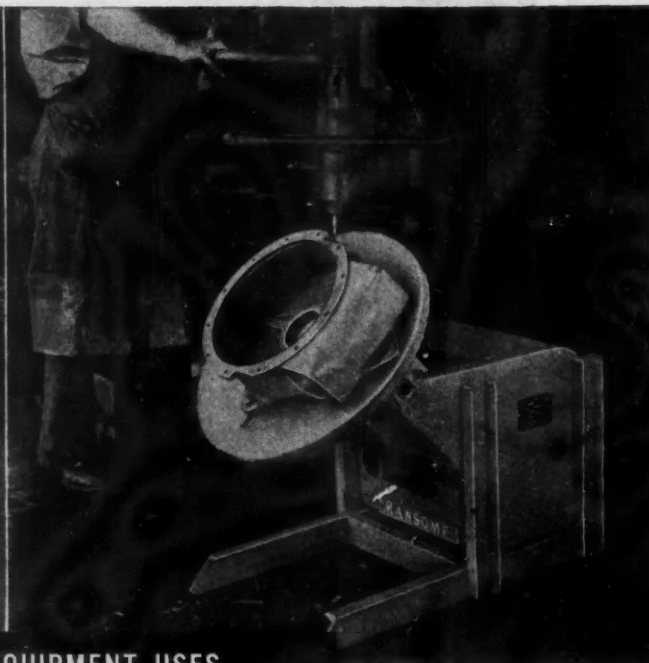
WORK ACCESSIBILITY
in any manufacturing process means lower costs, greater efficiency, better quality, and increased production . . . Ransome Positioning Equipment is widely used for tilting and turning a great variety of products, so that workmen can do their jobs more easily and better.



IF WORK SIMPLIFICATION IS YOUR PROBLEM, INVESTIGATE THIS EQUIPMENT . . . IT WILL PAY DIVIDENDS .



FLAME HARDENING



DRILLING

POSITIONING EQUIPMENT USES

Welding • Parts assembly • Drilling • Flame hardening
Flame cutting • Hard surfacing • Chipping • Grinding
Cutting • Overhauling • Burnishing • Polishing • Plating

INDUSTRIAL DIVISION

Ransome
DUNELLEN, NEW JERSEY

MACHINERY COMPANY

SUBSIDIARY OF WORTHINGTON PUMP AND MACHINERY CORPORATION

Redmond

ONE-TENTH H.P.



ANNOUNCES NEW D.C. MICROMOTORS

... FOR AUTOMOTIVE HEATING
VENTILATING and AIR CONDITIONING

YOU THINKERS have something far advanced and dependable to work with in the new Redmond D.C. Micromotors with ratings from 1/20th up to 1/10th horsepower.

For they were especially created to handle the automotive industry's new heavier tasks in heating, ventilating and air-conditioning.

Patented modulated magnetic fields cut out vibration and mechanical and magnetic noises.

Cushion mounted armatures retain smooth, quiet performance.

Direct feed lubrication, filtered through porous bronze, circulates uniformly over bearing surfaces. Long life is assured by super-capacity reservoirs.

You get micro-tolerances, impregnated windings, quiet commutation and power-saving silicon electric steel laminations. You get freedom from friction that adds millions of revolutions—and efficiency without a peer.

They're beautiful pieces of workmanship, and they have neat modern lines to impart a fine impression where Micromotors are exposed to view.

Complete information is available right now. Ask about new Type "J" Redmond Micromotors.



Micromotors are in the fight throughout the world

A. G. Redmond Company

OWOSSO, MICHIGAN, U. S. A.

REDMOND PRODUCTS
D.C. Micromotors up to 1/10
h.p.
A.C. Micromotors up to 1/20
h.p.
Dynamotors up to 200 W.
output
Controllers, reactor type
Blowers up to 125 cfm

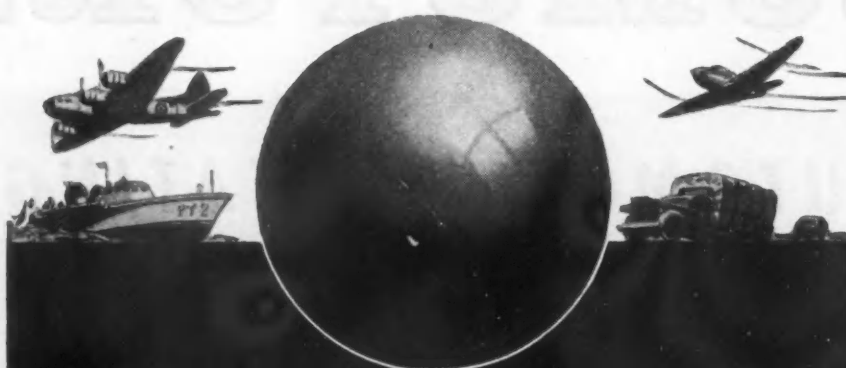
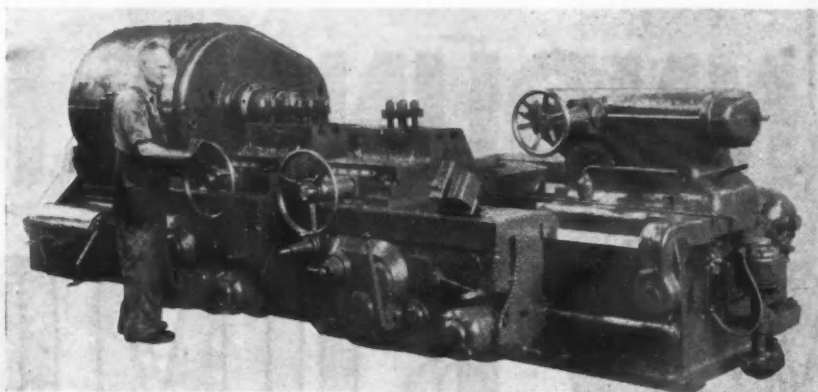


*Composite sketch of Redmond
facilities with over 5
acres floor area*



Wickes Brothers lathe

rapid turning shafts, hydraulic expanding mandrel for driving the work which is chucked on the mandrel and on a dead center in the tailstock. It has two heavy duty carriages and aprons with independent automatic feeds, with power rapid traverse and quick change gear box. One carriage is fitted with a cam arrangement for feeding the tool along a curved line in order to form the nose of the shell. All controls are designed for easy operation and located for the convenience of the operator.



STROM STEEL BALLS

Now at War - Later in Peace

Strom Metal Balls are now being used in the vehicles of war. But in the peace to come, they will again be dedicated to the designing and building of better methods for air and automotive transportation.



Largest independent and exclusive metal ball manufacturer

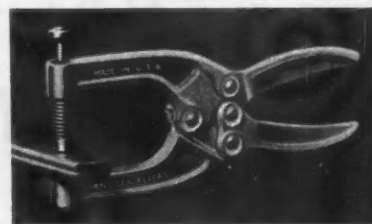
Strom

STEEL BALL CO.

1850 South 54th Avenue • Cicero, Illinois

KNU-VISE, INCORPORATED, Detroit, Mich., has placed on the market an improved plier which provides a self-setting pressure spindle to compensate for variations found in the thickness of sheet metal or other material clamped.

It is styled the Model KL-450 Vari-grip and was designed especially to



Model KL-450 Vari-grip

meet conditions found in the aircraft industry where the holding of skin or metal on airplane wings during riveting operations presented a new problem.

The Vari-grip is 8 in. long and weighs 22 oz. Its throat capacity is 0 to 3/4 in.; depth is 2 1/2 in.

THE Topflight Tool Co., Towson, Md., presents a new tool to the manufacturers of mechanisms requiring very small drills.

It is the Topflight "Baby-Giant" broken drill holder which holds drills from No. 80 to No. 60 and permits the use of small pieces of broken drills which would otherwise be discarded. Accurate, concentric drilling is said to be assured through a self-locking device which holds the drill fragment firmly in place.

Russell to Direct NAWPC on Consultant Basis

Frank F. Russell, general manager of the National Aircraft War Production Council in Washington, D. C., will direct the organization on a consulting basis after September 1.

A former director of Lockheed Aircraft Corporation and widely known here in industry circles, Mr. Russell will have the responsibility of general manager of the national council, but will devote part of his time to other business interests.

PROGRESS REPORT ON

POLYTHENE

A NEW PLASTIC BY DU PONT

In polythene, Du Pont introduced to this country a plastic remarkable in its electrical properties, low water absorption, resistance to solvents, impact resistance over a wide range of temperatures, low temperature flexibility without plasticizer and low specific gravity.

Du Pont research has further developed and improved polythene for wire and cable covering. Polythene is being used in the field of insulation for high-frequency cable; and, on military communications wire, where the electrical properties of polythene lengthen the talking range, and its light weight is advantageous for carrying long coils of wire.

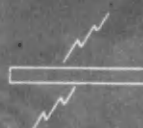
The ease of molding and extrusion of polythene and its excellent physical properties offer broad possibilities in military and postwar applications: in the aircraft industry for wire insulation and other uses, in refrigeration for parts and thermal insulation, in the chemical field for tubing, gaskets and protective coatings, and in packaging for closures and container purposes.

On proper application, polythene can be secured for experimental purposes in five-pound quantities according to WPB Order M-348. Write for polythene properties chart and other data to E. I. Du Pont de Nemours & Co. (Inc.), Plastics Department, Arlington, New Jersey.

FOR WHAT'S NEW IN PLASTICS

CONSULT **DU PONT**

Polythene was originated in England by Imperial Chemical Industries, Ltd. In this country, polythene has been developed and improved by Du Pont, which is the exclusive licensee under the basic patents on this plastic (U.S.P. 2153553 and 2188465). At present, Du Pont is producing polythene for important war purposes.



Dielectric strength, short-time —
V/M—2000 (.010")

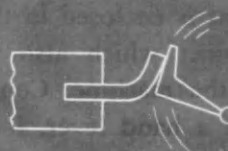
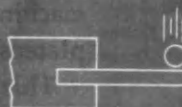
Dielectric constant, over range of
frequencies up to 10^5 cycles—2.3
Power factor, over a wide range of
frequencies up to 10^5 cycles—
less than 0.0005

Unusually resistant to solvents
and chemicals



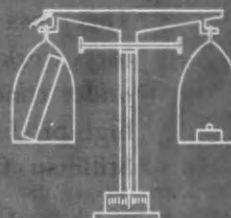
Water absorption, % — 0.04

Impact strength, Izod, —70°
F., +170° F. — .37 (does not
break in 4 ft.-lb. machine)



Polythene remains
flexible at temperatures
below —40° F.

Specific gravity —0.92



BETTER THINGS FOR BETTER LIVING
... THROUGH CHEMISTRY

THIS PRESS SERVES *Many* PURPOSES

For general utility work in the plastic or metal-forming industries, Watson-Stillman has designed this ALL-PURPOSE Hydraulic Press. It is made in sizes and capacities to suit varying conditions — from the 20-ton machine with 8 x 8 in. platens, to the 200-ton machine (shown here) with 20x20 in. platens.

This press is sturdy, compact, self-contained and oil operated. The power equipment is enclosed in the welded steel cabinet which also forms the base of the machine. Control is by means of a hand lever, located conveniently on the front of the machine. This press is ideally suited for laboratory work to perform experiments under conditions approaching actual high-production service. The Watson-Stillman Co., Roselle, New Jersey.



WATSON- STILLMAN

BULLETIN No. 370-A

Watson-Stillman has just prepared Bulletin No. 370-A covering the complete line of these General Purpose Presses. Detailed descriptions of the machines, their construction, equipment, and specifications of the several sizes and capacities are included. Write on your business letterhead for your copy.

DESIGNERS AND MANUFACTURERS OF HYDRAULIC EQUIPMENT, FORGED STEEL FITTINGS, AND VALVES

Fasten **ANY MATERIAL** More
Efficiently and Economically
with
HOLTITE
SCREWS AND BOLTS

No matter how many problems and worries confront you concerning the kind of material best suited for fabrication in your reconversion to peacetime production—your **FASTENING** worries have already been eliminated for you!

Whether you use plastics, alloys, wood, steel, brass, bronze, aluminum, castings, hard rubber, or any other material, there is a **HOLTITE** product designed especially to fasten it efficiently and economically... finished to match any material.

When special fasteners will effect greater economies or improve assembling, we are completely equipped to produce Special Parts and Fastenings exact to specifications, blueprints or samples.

Wartime conservation makes it impossible to send catalogs unless requested on your company letterhead



HOLTITE-Phillips
Recessed Head
SCREWS & BOLTS

Recessed Head permits safe power driving to cut fastening time and costs in half. Stronger, neater job results—no spoilage, injuries, burred or broken heads.



Thread-Forming
Sheet Metal Screws

Eliminate tapping operations—these hardened screws cut perfect mating threads as they are driven in sheet metal, plastics, castings. Tighter fit to defy vibration.



"Lock-Tite"
Assembly Screws

The lock washer is an integral part of the screw—a **HOLTITE** fastening innovation that embodies in **ONE UNIT** more advantages than separate lock washer and screw assemblies.

Planned Materials Handling

(Continued from page 41)

crated, then put in stock on low shelves for easy accessibility, and fed as needed to the assembly lines. Time studies revealed that crating required nearly 20 minutes and uncrating took another 20 minutes—counting all the operations involved. Here was a fruitful field for saving time, and for conserving wood, a much needed material. Out of that study came a new and astonishingly simple method:

Crating was entirely eliminated.

Units are fastened in pallets at the supplier's plant—12 to a single layer, 3 layers high, totally 36 units, metal strapped for security.

Carloading and unloading is done by industrial fork trucks designed for that purpose; and pallets are transferred to and from freight cars on trailers hauled by industrial tractors.

Shipping and receiving checkers see at a glance—12 units per layer, 3 layers.

Pallets are handled at both ends by fork trucks. Units never leave the pallets until they reach the assembly lines.

Pallets are tiered 11 feet high, utilizing an extra 4 or 5 feet of storage space that had theretofore been useless.

Advantages of the new system are obvious. It is much quicker. It is far easier. It saved 19 man-hours on each pallet of 36 units. And it instantly showed a tidy \$21.60 lopped off the delivered-to-line cost of each 36 units, through saving on material as well as labor. Now this is an actual case history—and has been many times repeated throughout the country. It typifies what must take place if industry, in the days to come, is to condition itself for the tough competitive battle from which there will be no escape.

One fact in this experience stands out conspicuously, and will be spotted instantly by executives who are on the alert to make their materials handling methods more efficient. It is this: A completely mechanized system of handling materials virtually eliminates unskilled labor; and it is a demonstrable fact that *unskilled labor adds nothing to a product except cost*. That cost item can never be entirely done away with, in all probability; but it can be reduced to where it "approaches the vanishing point."

Advertising Note

Kerkling & Company, Bloomington, Ind., has appointed Behel and Waldie and Briggs, Chicago, to direct its advertising account.

CONTINENTAL
SCREW CO. New Bedford, Mass., U.S.A.
BUY MORE BONDS

Adjustable Cooling Fan For British Radial Engines

ROTOL AIRSCREWS LTD., a British company controlled jointly by Rolls-Royce and Bristol Aeroplane Co., recently introduced an 18-bladed fan assembly said to be readily adapted to many air-cooled engines now in service and in production, particularly Bristol engines so extensively used in British aircraft. Intended to be located in the annular space between the spinner and

the front of the engine cowl, and driven at the same speed as the propeller, the assembly is flexibly attached to the back plate of the spinner by "rubber cushion" mountings to prevent the fan from vibrating in phase with the engine.

The fan consists of a ring with the blades attached in such a way as to permit the blade angle to be readily ad-

justed to suit any climatic conditions, and to allow either one or several blades to be replaced in case of damage by accident or enemy action.

Further assistance to cooling may be given by the provision of fixed guide vanes either in front or behind the rotating fan, to streamline the air flow and ensure uniform distribution. Control of the additional cooling during



Amazing New Four Spindle Turret Attachment for Drill Press!

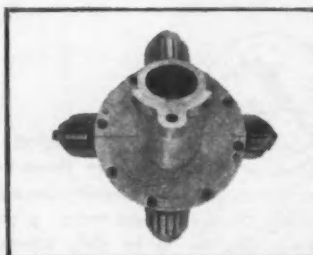
New one drill press can do the work of four and, at the same time, effect a savings of up to 75% in floor space, with the "Quadri" attachment. This rotary device will accommodate four boring or cutting tools at the same time, yet one tool only is in motion when the head is in operating position.

The entire unit is assembled to the quill of the drill press and is driven from the drill press spindle. Accuracy and rigidity of alignment of the "Quadri" are assured by the special construction of the driver and spindles, thus efficiency is only limited by the accuracy and power of the drill press itself.

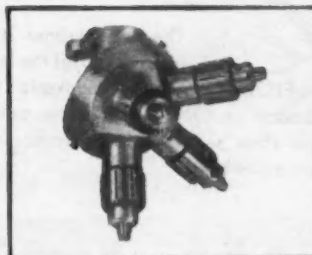
Foolproofing in indexing is accomplished by visual markings and by the relationship of the index pointers on the index disc, as well as the extension of the spring retainer. Four hardened and ground spindles are fitted for No. 32 Jacobs chucks or their equivalent. To provide correct positioning at all times, the entire spindle assembly is located by means of an accurate fitting of recess and undercut, between turret and bearing housings. The hardened friction starter and driver have been so constructed that at any speed proper synchronization of the driver teeth is accomplished without clashing.

It goes without saying that our fighting men must have the finest possible quality materials home industry can produce. So, although the stock of quality raw materials from which Wrigley's Spearmint chewing gum is made is growing steadily smaller, they are still maintaining pre-war standards. However, they can now make only a portion of their former output, so all of this limited production is going to our fighting men and women overseas only... where it is an "on-duty" need.

You can get complete information from Chicago Drillet Corporation, 919 N. Michigan Ave., Chicago 11, Ill.

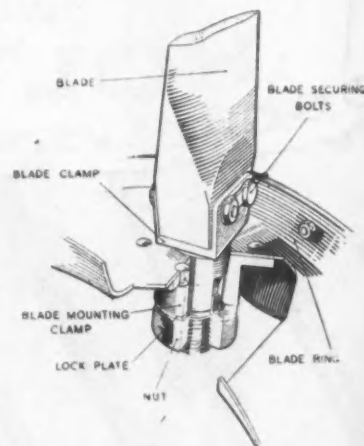


Quick and positive indexing assured by pointers on index disc



Quadri assembly complete ready for attachment to drill press

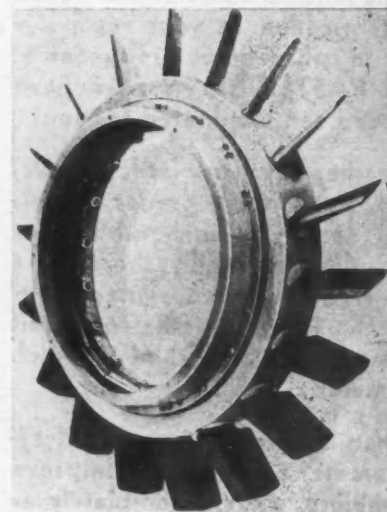
Y-140



Blade mounting and angle adjustment on Rotol fan

normal and high-speed flight is effected by the controllable gills.

Adjustment of blade angle is made by removing the tab-locked nut at the inner end of the blade, tapping the base of the blade clamp to ease it out of the



Rotol adjustable fan

taper socket of the blade mounting clamp, turning the blade to the required angle and refitting the nut to draw the assembly tight into the taper bore of the socket.

**Save and Win
with War Bonds**

*More Freight
for the Skyfreighter*



THE SKYFREIGHTER
of
AMERICAN AIRLINES
FLAGSHIP FLEET

ON STRONGER, SAFER TIRES

UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK 20, N. Y.





THE SKYFREIGHTER WEIGHS IN!

NEWEST addition to American Airlines Flagship Fleet is the Skyfreighter, carrying a useful load of 8826 pounds over American's transcontinental route.

The Skyfreighters are among the twenty-five planes now being returned to American Airlines by the Army and are actually the Flagship Sky-sleepers which the Army took over in the spring of 1942. They have been put through a complete conversion program by American to provide facilities best adapted to carrying cargo based upon American's long experience as an air cargo carrier.

Here a Skyfreighter is officially weighed-in before she starts on her maiden flight. With scales under each of the landing wheels and another at the point from which the ship is suspended, the job is done quickly and easily. Regular weighing is important because airplanes, too, grow heavier as they grow older.

From July, 1941 to June, 1944 the average useful load carried by American Airlines Flagships has increased more than 50%. This extra load, made up of passengers and cargo, means extra work for tires. It makes tire quality and tire care more important than ever.



BY READING THE WEIGHTS recorded under each landing wheel and at the point of suspension, the total is quickly calculated. With every ounce of payload needed for wartime cargo, accurate weighing is more than ever necessary.

1230 SIXTH AVENUE

UNITED STATES



HOW AMERICAN AIRLINES CONSERVES TIRES WHILE ITS 50 PLANES DO THE WORK OF 82!

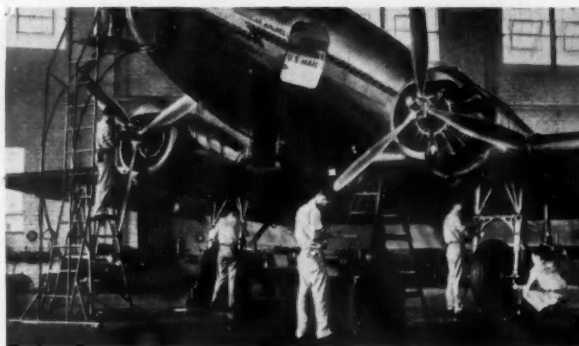


IN JULY, 1941, American Airlines operated 82 planes, a daily average of 7 hours and 39 minutes. In June, 1944, the Flagship Fleet consisted of 50 planes, with each plane scheduled for 13 hours active service every day. In 1941, the 82 planes turned in

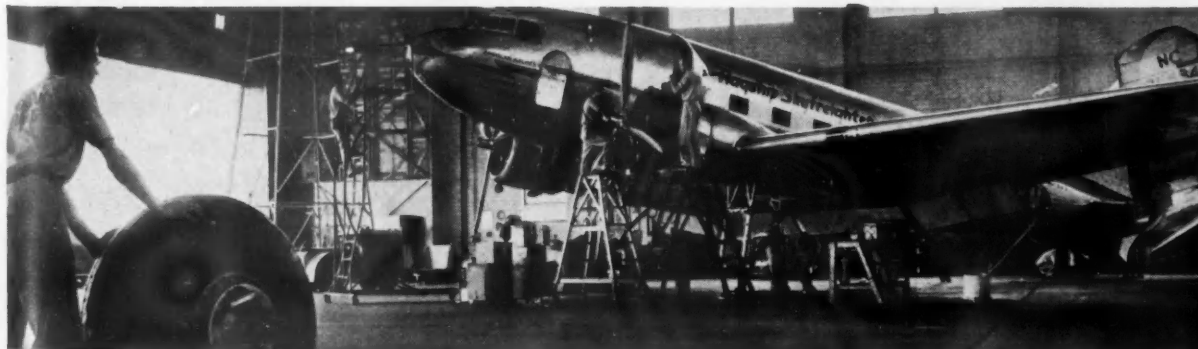
605 hours of scheduled service. In 1944, the 50 planes worked 650 hours. That's one big reason why American has a maintenance department of over 3000 men and women...to keep the Flagship Fleet always at peak efficiency.



SERVICE INSPECTION...Whenever a Flagship rolls up to an American Airlines Terminal, one of the regular procedures followed by the ground crew is to give the tires the "once over" and report any signs of trouble at once.



LINE (OR BASE) INSPECTION...When the Flagship reaches its final terminal for the day, radio equipment, fuel and oil are checked. Landing gear, fuel, hydraulic and electrical systems and other vital parts are inspected.



GENERAL INSPECTION...At general inspection, every Flagship is checked over to the last detail by expert mechanics skilled in each specialized operation. Wheels are removed and tires, brakes and axles inspected. Where necessary, tires are removed

and checked inside and out. Injured tires are returned to the manufacturer for repair. Smooth tires are returned for new treads. Under this carefully organized and rigidly supervised procedure tire failures at American are practically a thing of the past.

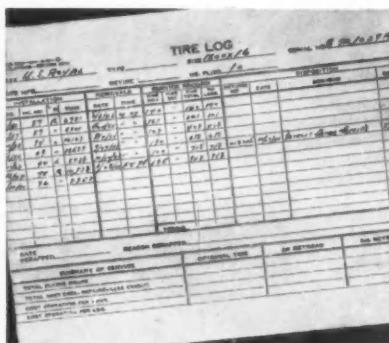
RUBBER COMPANY ROCKEFELLER CENTER • NEW YORK 20, N. Y.



WITH FLAGSHIPS LANDING on an average of once every hour instead of once in two hours and with pay loads 50% greater than in 1941, these U. S. Royal Airplane tires have a bigger job to do than ever before—and they are doing it!



IN THE RECORD SECTION of American's Maintenance Department, every tire has its own Tire Log. From the ship's log, the record clerk transposes each step in the tire's life from original installation to final removal.



THIS IS THE LIFE LINE of a U. S. Royal that made better than 700 landings before it was sent to the "U.S." Tire Factory at Detroit for recapping. If the tire body is still in good condition, a new tread will be applied and the tire put back in service.



THERE IS A TIRE LOG on file for every tire that ever flew on an American Airlines Flagship. From these records, data are supplied to airplane tire makers helping them to design stronger airplane tires to carry the greater loads of today and tomorrow.

SERVING THROUGH SCIENCE



TO SPEED THE VICTORY

UNITED STATES RUBBER COMPANY

1230 SIXTH AVENUE • ROCKEFELLER CENTER • NEW YORK 20, N. Y.

Wide Variety of Gears Foote Bros. Plants

(Continued from page 30)

The first of the preparatory plants handles miscellaneous parts produced from forgings only. The variety of gears, shafts, and other items are handled completely from the rough forging, machined, heat treated, and prepared for the finish grinding operations in the main plant. Interesting feature of these two plants is the principle of arrangement of departments according to operational or functional methods depending entirely upon the production volume of an individual part.

Here and there, where parts are produced in large volume sufficient to justify a centralized functional arrangement of process, the observer will find completely self-contained machine lines so equipped as to handle the gamut of operations from the rough forging to the finish piece. Such lines are comparable to a multi-operation specialized single-purpose machine. They have no flexibility since they are tooled to produce but one item. But they have great productivity and cost economy. Usually the machine lines are arranged in parallel rows facing each other with inspection benches in between. For smaller volume runs on other types of parts, the process is conventionally operational. Here the work is routed from one department to another until the various operations have been completed.

This plant boasts a variety of the most modern equipment known to the art. Turning and forming is done on turret lathes of popular makes—Jones & Lamson, Warner & Swasey, Gisholt; on automatic lathes such as Fay, Sundstrands and Gisholt. A battery of towering Bullard Mult-Au-Matics is employed for the rough- and finish-turning and forming of gear blanks required in large quantities. A variety of Cincinnati and Kearney & Trecker vertical and horizontal milling machines also are found here.

As a matter of cardinal principle, all gears for Pratt & Whitney engines have ground teeth. The basic process is to cut all spur gears and splines on hobbing machines or shapers, then finish grind. For this purpose they employ a large number of Barber-Colman horizontal hobbing machines, the new Barber-Colman single-spindle vertical type hobbing machines, Cleveland vertical type, single-spindle hobbing machines, and Fellows No. 6 and No. 7 shapers.

However, cluster gears and gears with shoulder interference are cut on the versatile Fellows gear shapers, shaved on Fellows and Michigan rotary-cutter type gear shavers, then lapped on Fellows gear lappers. Internal gears are cut on Fellows gear shapers, small gears are lapped on

Fellows gear lappers, larger ones are ground.

Splined bores and small holes of special shape are produced by hole broaching. Large splined bores are broached in a huge horizontal American broaching machine. A vertical type Colonial broach is used for forming pear-shaped holes in a previously drilled flange.

One of the interesting pieces of equipment is a large horizontal W. F. &

John Barnes two-spindle gun drilling machine for drilling a gallery through a long forging. A variety of grinding operations are performed on familiar types of equipment such as Cincinnati Filmatic grinders, Heald internal grinders, Bryant internal grinders.

The second of the preparatory plants is an even more extensive establishment, designed to handle the larger variety of gears and parts, made both from forgings and bar stock. Distinguishing feature is a large automatic department high-spotting a huge Conomatic and smaller companion Conomatic which is dwarfed by com-



STOP WHEEL SPIN ON SNOW PLOWS Get Positive Traction with

Start now to fix your snow plow trucks so the wheels will pull (not spin) in deep snow or on slippery, icy roads.

Install the Thornton Automatic-Locking Differential in place of the conventional type. This eliminates one wheel going dead and other wheel spinning. Both wheels must rotate when power is applied. Motor cannot drive either wheel faster than ring gear speed. Prevents wheel spin . . . tire grinding . . . skidding due to loss of tire grip on ground.

Worth looking into *right now*. Send coupon for full facts and catalog.

THORNTON Automatic Locking DIFFERENTIALS



Available with—Limitation
Order Certificate L-158.

THORNTON TANDEM CO.

8775 E GRINNELL AVENUE • Plaza 9700
DETROIT 13, MICHIGAN

Make Big Trucks Out of Little Ones with the
THORNTON Four-Rear-Wheel DRIVE

In U.S.: Sold by TRUCKSTELL DISTRIBUTORS
In Canada: H.V. WELLES, LTD., Windsor, Ont.

SEND COUPON TODAY

THORNTON TANDEM CO.
8775-E Grinnell Ave. Dept. AA-2
Detroit 13, Mich., U.S.A.

Please send me data on your Automatic-Locking Differential.

Name
Address
City State
Make and Model Year

parison. In addition, this department has a heavy complement of turret lathes, including Jones & Lamson, Potter & Johnston, Warner & Swasey.

There also is a sizable battery of the large American Pacemaker lathes used primarily for the turning of long shafts. This operation is extraordinarily fast owing to the use of special steel cutting grade cemented-carbide tools. In fact, it is amazing to see how fast alloy steel can be removed when using the proper grade of c-t-c tool on a rigid, heavy duty machine.

Perhaps one of the most interesting

operations in this plant is the honing of a small bore in a relatively long shaft. This is done on a battery of two new Micromatic vertical Hydrohoners, fitted with small Micromatic honing tools. Some idea of the degree of precision required may be gained from the statement that the bore must be held to 0.0007 in. tolerance, 0.0002 in. permissible error of roundness, 0.003 in. permissible taper.

Another outstanding operation is the broaching of a large diameter spline bore having accurately formed teeth. Formerly this was done on a gear shaper with a consequently long time

cycle. Now the job is done in one pass on a large vertical Colonial broaching machine.

This plant contains the main gage laboratory housed in an air-conditioned and sealed room. It is outfitted with the most modern gaging equipment known to the art, including a Pratt & Whitney Supermicrometer, a Bausch & Lomb Comparator, Michigan lead checking machine, Sheffield length measuring machine. Prize exhibit is a special Vinco optical inspection machine with a dividing head which can literally divide the circle into a million parts.

Here, too, is found the main metallurgical laboratory for controlling the quality of incoming raw materials and for providing production control of heat treatment. Among the larger pieces of equipment in this lab is one of the latest of the Baldwin-Southwark hydraulic tensile testing machines.

Heat treating facilities for both preparatory roughing plants are centralized here. Most impressive is the adoption of continuous type Holcroft gas-carburizing and hardening furnaces, said to mark an important departure from batch-type heat treatment of aircraft quality gears. These furnaces are of two-row and three-row construction with differential control of the speed of each hearth. This makes it possible to run entirely different types of parts simultaneously through the same furnace, the heat treating cycle for each one being a function of the speed to which the hearth is adjusted.

Wherever the design of the parts so dictates, the work is quenched in the familiar Gleason quenching machine. A Foote Bros. contribution to this procedure is the development of a technique for quenching four small gears at a time in a quadruple die. To this end, they have designed a special forked tool which makes it possible to lift two gears at a time and set them into the fixture quickly and accurately. Two operators are required to load one machine. Lindberg pit-type furnaces are used for drawing operations and for producing some special nitrided parts.

Finally we reach the main plant of the group—and the most modern since it was designed specifically for the purpose. This is the finishing plant. Its function is to complete the operations on all parts produced in the two preparatory plants.

Without going into the details of specific operations, it may be visualized as a finish-grinding plant in all its ramifications. Here will be found Cincinnati and Norton plain grinders, and Landis and Cincinnati angular head grinders; a large battery of Heald internal grinders of various types and sizes; a large battery of Bryant internal grinders; some of the big Hanchett surface grinders.

Perhaps the largest floor area is devoted to gear grinding with one department equipped exclusively with Gear-grind machines for gear tooth grinding and for spline grinding. Too, there



an ANTI-FRICTION WORLD

EVERY HEADLINE PULLS IT CLOSER TO REALITY—a world that will benefit from the brilliant inventive triumphs of war production; truly an Anti-Friction World. We know . . . for Aetna is helping to plan and achieve it.

Scores of new products, hundreds of old products redesigned; will operate more smoothly, more economically—countless war-worn plants will be revamped, rejuvenated: all by judicious application of anti-friction bearings.*

Have you made sure that your product and your plant will be ready for tomorrow's competition?

Aetna can help you. Time used for laying solid foundations of your future business is time well invested. A line or call to us makes the contact. Aetna

Ball Bearing Manufacturing Company, 4600 Schubert Avenue, Chicago, Illinois.

IN DETROIT: SAM T. KELLER, 7300 WOODWARD AVENUE, PHONE: MADISON 8840-1-2.

MAKERS of
THRUST BALL BEARINGS,
Standard and Special
ANGULAR CONTACT
BALL BEARINGS
ROLLER BEARINGS
Special,
BALL RETAINERS
HARDENED and
GROUND WASHERS



Aetna

BALL BEARINGS

SO....you thought you knew how tough **LUMARITH** is...

A Celanese Plastic

WELL...TAKE ANOTHER LOOK!

OF COURSE you know how Lumarith molded plastics stand out for toughness, impact strength. You've worked with them, seen their innate ability to take a beating—and like it!

Now take a look at the army message-carrier with the Lumarith bumpers on each end shown below. It's heaved from a speeding plane—hurles a couple

thousand feet to the hard, hard ground (maybe a rock). It lands with terrific impact. The streamer makes sure it lands on the Lumarith.

For this eye-opening performance, a Lumarith formulation more than met tough army specifications. How tough are your plastic requirements? Concerned about flexural strength, mois-

ture-resistance, clear-through color—and a dozen other "musts"? Why not consult with our technical service—now? *Celanese Celluloid Corporation*, The First Name in Plastics, a division of the Celanese Corporation of America, 180 Madison Ave., New York 16, N. Y.

*Reg. U. S. Pat. Off.



This army message-carrier has a light at each end protected by tough, transparent Lumarith caps threaded to the fibre cylinder. A twist of either cap contacts two pencil-type batteries which light the lamp. The carrier is then heaved from the airplane to the ground below.

Intake Pipe Coupling Ring

for aircraft engines, turned from AMS 5050 steel tubing. Despite an OD of nearly 3" and a thickness of less than $\frac{1}{4}$ ", roundness of hole must be held to .006" total indicator reading.



Finger Spring Button

Stainless steel aircraft ignition part. Although the small body is turned down to less than $\frac{1}{16}$ ", the head measures $\frac{3}{16}$ " across, is only .010"-.012" thick, and must be flat within .001".

Here's the Skill to make Precision Parts

large or small — in any quantity

Western Automatic's production ingenuity assures you extraordinary precision — at war-demanded speed!

No matter how complicated the part or how exacting your specifications, if its size falls between $\frac{1}{16}$ " and $4\frac{5}{8}$ " round, Western has the men and machines, the experience and skill to produce it, in war quantities, fast. The two pieces shown life-size above are but two of thousands of parts we've been making, many to still closer tolerances. You may need this kind of service now, you'll need it post-war. We'll be glad to quote on your requirements.

Our Business . . . is the manufacture of special screw machine products to specifications. Machine capacity ranges from $\frac{1}{16}$ " to $4\frac{5}{8}$ " round, with complete equipment for all types of secondary and processing operations, including precision grinding, heat-treating, hardening and penetrating.

Aircraft Products Division

Western Automatic

Machine Screw Company

Elyria, Ohio, U. S. A.

Precision Parts and Assemblies Since 1873

is an additional battery of Geargrind machines for internal grinding of gear teeth. Immediately adjacent is a huge battery of Pratt & Whitney gear grinders for handling the larger gears and splines. Fellows lapping machines also are employed in this department. Characteristic of aircraft quality work, a large area is devoted to the various intimate details of burring and polishing which are handled on benches with hand tools. Finally, there is an impressive array of final inspection benches on which all finished parts are inspected 100 per cent before acceptance for shipment to the customers.

The actuator power package, mentioned earlier, is produced in a smaller department located in a corner of the plant and employing 175 people. The primary operations are those of hand assembly on benches, followed by load and cycle testing for acceptance in special test machines.

The foregoing is necessarily a sketchy visualization of what is considered to be one of the most outstanding of the commercial and precision gear plants in this country. We have attempted to sketch a brief perspective without going into the wealth of detail that forms the background for any gear or assembly produced here. In the pictorial treatment, however, we have sought to provide glimpses in the four plants so that the reader may have a better appreciation of the character and scope of the activity.

Contract Terminations Discussed at Meetings

Designed primarily for small business firms having contracts or orders to make war materials for prime contractors or other subcontractors, a series of eight meetings devoted to problems of war contract terminations is being held in Detroit under the sponsorship of the University of Michigan school of business administration. The series started August 22 and will run until September 14, with classes held two hours, two evenings a week. The first hour of the first six meetings is devoted to a lecture by the discussion leader, and the second hour is given over to related problems and answers to individual questions. The last two meetings will be panel discussions of questions presented by members of the class.

Subjects covered include legal rights and responsibilities of contractors, elements of the termination claim, accounting preparation for termination, procedure of property disposal, financing termination, preparation for termination, typical termination problems, and the panel discussion.

New Office Opened

Bliss & Laughlin, Inc., have opened a new sales office in Hartford, Connecticut, to provide better service in the distribution of their cold finished steel products.

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many requests from men in industry
that we reprinted a limited number.

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covering the great majority of "specs"
listed there. Preventing rust has been
our aim long before war production
made the problem more acute. We can
help you, if you'll state your needs.

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Profit Margins Continue at Low Level

(Continued from page 17)

process swelled beyond all previous conceptions of our economy. Yet sheer bigness forms part of the criticism of what appear to be profits in this nation. There has been little said concerning the fact that net profits have not kept pace with increasing responsibilities and that profit margins have fallen below normal ratios (see accom-

panying Profits and Taxes table). The final net profit margin after taxes, for manufacturing alone, was about 3.3 per cent of gross receipts in 1943. This was far below the experience of World War I and the boom of 1929. It was also below 1936, 1937, and 1939 profit margins.

It is estimated by the United States

Department of Commerce that total corporate net profits of all corporations in the United States for the year 1943 will aggregate at \$8.2 billions. It is estimated by the same Department that \$4.4 billions of this sum was paid out in dividends for the use of capital—an amount not far different from pre-war years.

That left \$3.8 billions for working capital, the money which will help create the jobs and products of peace. This sum is not entirely cash. Much of it is represented by huge, war-built inventories which may assume doubtful values when peace comes. Another portion of it is held as "accounts receivable." It would be a rare businessman who could say what these "accounts receivable" will be worth in the face of renegotiations, or when they will be paid.

As a matter of fact, there is really no complete record of corporate profits in recent years. There are estimates made by both the United States Treasury and the Department of Commerce. There is a difference between the two official profit versions, indicating the difficulty of estimating results accurately. However, the Department of Commerce figures are used here because they have been explained in detail by Government publications and widely publicized.

In the controversy about profits, size appears to be one of the main points of critical fire, yet big figures simply reflect the immensity of the job this nation has done to carry a war based on production to every fighting front. The critics of "size" might just as well harry an elephant because it is not a mouse.

In the flexing of our economic muscles for war, national income soared to \$147.9 billions, an increase of 108 per cent over 1939. Wages and salaries skyrocketed, too. They reached a peak of \$102 billions, an increase of 131 per cent over 1939. The statistical device known as the "physical production index" is the real tip-off on just what "big figures" really reflect. That index represents real, honest-to-god, tangible goods and products. It hit 258 in 1943. It was 109 in 1939. Within the scope of that simple "number" are the clouds of planes over Berlin, the roaring naval guns off Truk, the clattering tanks on the Italian roads, the vicious chatter of machine guns along the mighty stretch of the Russian front, the food Americans eat, and the clothes Americans wear.

Big figures? Certainly! How could small ones mirror an economy doing the job this one has done and is doing?

Profit Margins Have Been Steadily Lowered

In the World War I year of 1917, gross receipts of all corporations in the United States totaled \$84.7 billions. Net income that year, before taxes, was \$10.1 billions. Income taxes took \$2.1

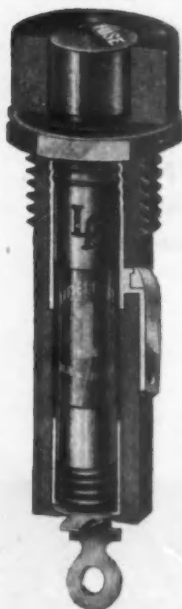
(Turn to page 96, please)

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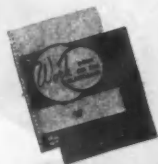
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These high carbon steel breech blocks are loaded on the continuously moving 30" magnetic chuck of a No. 16A Blanchard Automatic Surface Grinder.

Each piece goes through the machine four times, a roughing and a finishing cut removing .030" stock from each surface. Production is 350 pieces (700 surfaces) per hour. The pieces are automatically unloaded and demagnetized. Size is automatically held to $\pm .001$ ".

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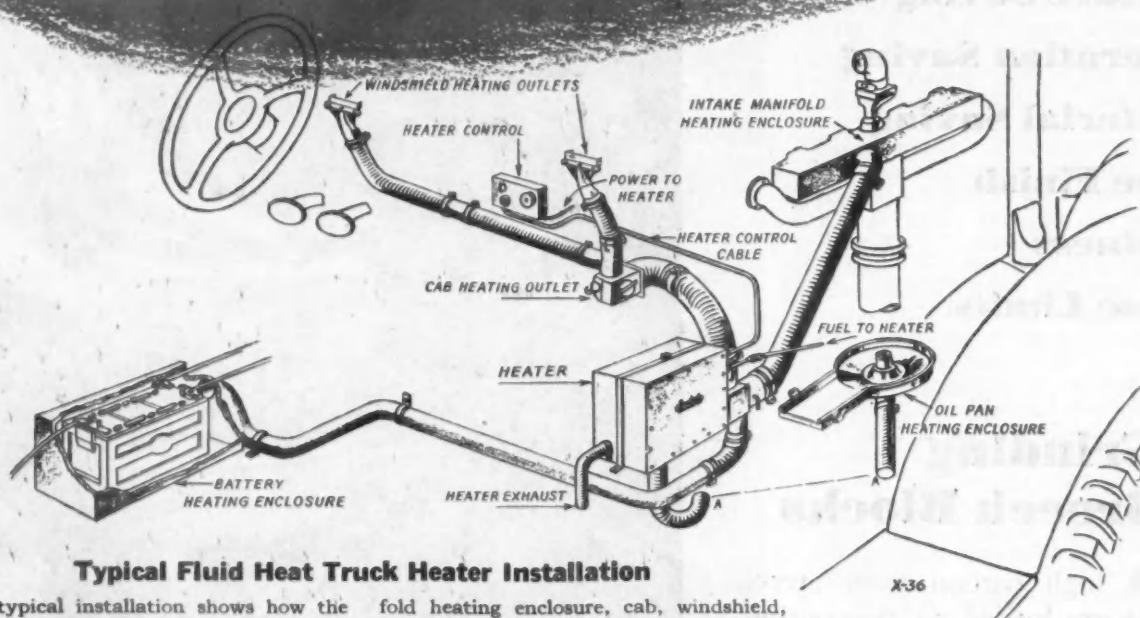
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The BLANCHARD MACHINE COMPANY

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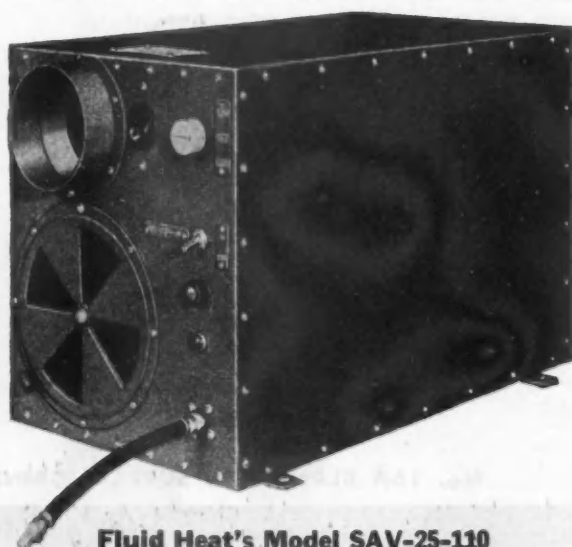
fluid heat TRUCK HEATERS DO A



Typical Fluid Heat Truck Heater Installation

This typical installation shows how the compact and efficient Fluid Heat under-the-hood Truck Heater does its all-around job. Heat goes by ducts to the intake mani-

fold heating enclosure, cab, windshield, battery heating enclosure and oil pan heating enclosure. The entire system is controlled by a switch on the dash.



Fluid Heat's Model SAV-25-110

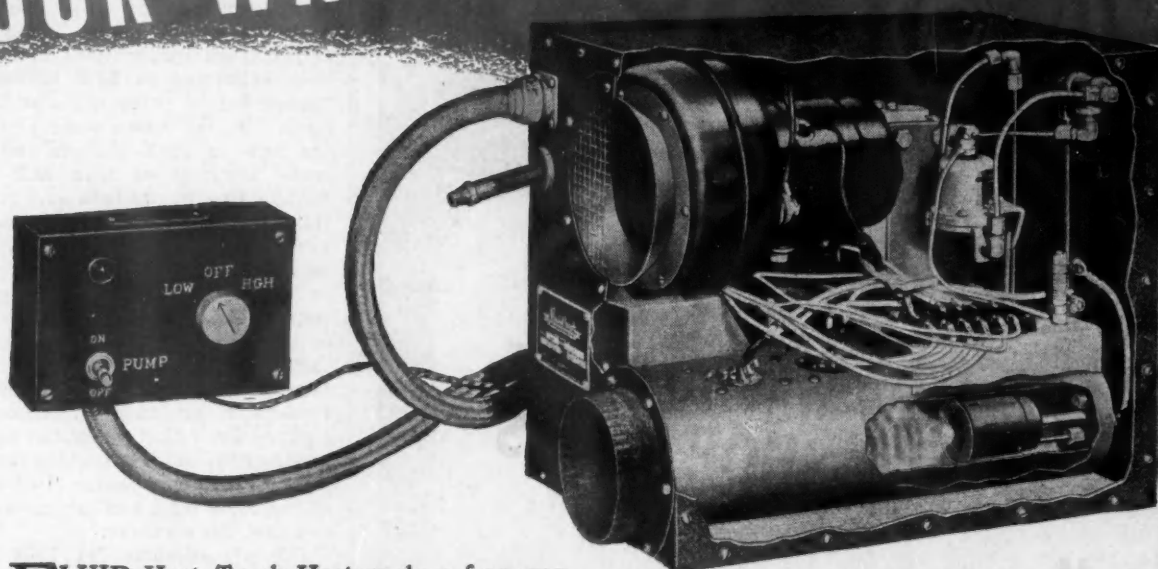
This model illustrates the flexibility of Fluid Heat's heat engineering know-how. Designed by request for use in trailers housing mobile laboratories, it operates on 110 A. C. and delivers 25,000 BTU per hour. Fuel is drawn directly from the tank of the vehicle. Dimensions are 17¹⁵/₁₆ by 10¹/₄ by 12¹/₁₆ inches.



Fluid Heat's Model SAH-15T

Designed for trailer and cargo-space heating, this model has an output of 15,000 BTU per hour and has a convenient hand-replenished fuel tank compactly built onto the top. Built-on tank makes the heater a completely independent, self-contained unit, permitting uncoupling of trailer without fussing with fuel lines.

FOUR-WAY HEATING JOB



FLUID Heat Truck Heaters do a four-way heating job on trucks, trailers and busses. They warm the operator's cab and defrost windshields, heat cargo or personnel space, produce quick and effortless cold-weather starting by pre-heating batteries, engine manifold and crank case. Mounted on wheels or runners, they pre-heat engines of bulldozers, cranes, compressors and other machinery where heat is an aid to starting or operating. They are ideal for vehicles where men or machines require heat to operate most efficiently and economically.

Fluid Heat Truck Heaters fit compactly under the hood, in the chassis, or in cargo or living space. They control from the heater itself or from the dash. They burn any grade of gasoline, drawing direct from the vehicle's fuel supply or from built-on fuel tanks of their own. The new and exclusive combustion process of *vapor entraining*, proved in Fluid Heat Aircraft Heaters, assures maximum combustion efficiency, freedom from lead oxide formation, longer life for burner parts. There are only three moving parts—motor, fan, standard automotive-type pump.

Fluid Heat has, for sixteen years, pioneered in the development and manufacture of automatic

Fluid Heat's New Model SAH-20 "Under-the-Hood" Truck Heater

This heater has a maximum output of 20,000 BTU per hour, yet weighs only 21 pounds, fits easily under the hood of any truck. Overall dimensions are 7¼ inches wide, 10½ inches high, 12 inches long. To insure clearance, heater can be placed in almost any position. Pump enclosed in the unit draws fuel direct from the truck's fuel tank. All models operate on 6, 12 or 24 volts D. C. or 110 volts A. C. Model SAH-40, not shown on these pages because it is identical in design, delivers 40,000 BTU per hour. It is 13 inches by 10½ inches by 19 inches, weighs 40 lbs.

combustion and heat transfer equipment. Those years of heat engineering know-how are built into each compact, economical, efficient Fluid Heat Truck Heater. You'll want Fluid Heat Truck Heaters on the trucks, trailers, busses, cars or other vehicles you design, build or equip. Write for full information on this new heat engineering achievement.

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The sub-zero expansion fit is not only more economical—it is faster and safer. It does not induce mechanical strains within the male part. There is no danger of scoring the walls of the female member nor of misalignment of the male as it moves into position. There is no chance of bending or twisting of the male part in the operation. And the entire process is under close control.

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billions and net income after taxes was \$8 billions. Out of that sum in 1917 came dividends amounting to \$3.7 billions. Business "plowed back" \$4.3 billions. The profit margin before taxes in the last war was 11.9 per cent. After taxes, there remained 9.4 per cent net to the honest businessman and the "war millionaire" in their composite entity.

Any such margin for the over-all business community simply does not exist in this war despite the distortions of specific industry profits often used to indict *all* business. The gross receipts of all corporations in 1943 have been estimated at \$298 billions. Net income before taxes is set at \$22.8 billions. Income taxes were piped off to the tune of \$14.6 billions and net income after taxes was \$8.2 billions. Dividend payments took \$4.4 billions of this amount and left American enterprise with \$3.8 billions for its postwar future. The profit margin *before* taxes in 1943 was 7.7 per cent of gross receipts. After taxes it was 2.8 per cent on gross receipts . . . less one-third of the rate of profits realized in the first World War. There is nothing unreasonable or unconscionable yet in sight to show that American enterprise is out of line with American conscience. Even the "freak" cases cited by some of the most informed critics come back to haunt the accusers.

Official estimates for 1943 indicate that more than half of the nation's corporate profits have been paid out in dividends for the use of capital, in payments, incidentally, substantially lower than they were in the prewar years of 1936 and 1937. The rest of the nation's profits have been "plowed back" into the productive channels. Out of them will come the future jobs and industry of the United States.

America Will Need "Seed Money" for Jobs

The great white hope of the postwar planners is that we shall be able to reach a national income of \$125 billions. This is attainable only if industry is allowed to build adequate reserves out of reasonable profits. And every crystal ball in the nation shows a different concept of what an "adequate reserve" should be simply because the economic problems of peace are not yet blueprinted in their dollars-and-cents details. The national income in 1939 was only \$70.8 billions. The proposed national income for postwar will require far more working capital in industry than was ever had before the war. Everyone recognizes the fact that a prewar level of national income would not provide adequate employment, yet many protest the efforts of industry to get the funds to go ahead on a larger scale after the war.

At least this much seems probable—any such postwar goal will require about 25 per cent more capital as seed money to finance a larger program for industry and commerce, and this in

(Turn to page 98, please)

HYDRAULIC ENGINEERING



THE PRACTICAL experience of this company in building and successfully engineering The Eaton Rotor Pump to military needs is now made available to postwar designers. The proven efficiency and stamina of the Eaton Rotor Pump, *under fire*, foreshadow its successful peacetime use on such applications as:

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| <input type="checkbox"/> Cooling and Lubrication | <input type="checkbox"/> Servo Braking |
| <input type="checkbox"/> Hydraulic Steering | <input type="checkbox"/> Air Conditioning |
| <input type="checkbox"/> Automatic Transmission | <input type="checkbox"/> Crankcase Ventilation |
| <input type="checkbox"/> Fuel Transfer and Injection | <input type="checkbox"/> Remote Controls |



FROM CAMSHAFT TO COMBUSTION CHAMBER, Eaton products include parts for the complete valve assembly—Zero-Lash Hydraulic Valve Mechanisms, Mechanical Tappets, Self-Locking Screws, Valve Springs, Valve Seat Inserts, and Automotive and Aircraft Valves.



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turn can make possible about 25 per cent more jobs.

The brave, new world, or whatever other title the sloganites drape on the future, will still find its basic motivation in rewards for work done. Labor will produce to capacity only if it is sure that it will receive wages in fair proportion to what its efforts contribute to national output. Business enterprisers will be active, and will take risks of loss only if there is the prospect of returns on the same basis. Savers will invest only if there is some

assurance of return measured by the social usefulness of the capital they provide. But there must be reserve funds available now, created out of profit, if the jobs and opportunities of tomorrow's economy are to materialize in numbers enough to keep our living standards up to American expectations.

This article, "Profit Margins Continue At Low Level," was adapted from the report, "What's Behind the Hue and Cry About Profits?" published by the National Association of Manufacturers.

Industrial Diamonds

Industrial diamonds, particularly for the dressing of grinding wheels, are generally recognized as vitally important to the maintenance of our war effort in every segment of mechanical industry. Recent emphasis on the necessity for conservation of the available supply of industrial diamonds has focused attention on the importance of careful selective buying of these diamonds for specific uses. Equally important is the type of setting in which the diamond is mounted and the nature of the tool in which it is to be used. Likewise there is today greatly increased interest in determining the best methods of wheel dressing with diamond tools in order to prolong the life of the diamond.

Industrial diamonds are customarily merchandised in three grades, common, medium and select. Medium and select quality stones are always scarcer than the common quality and are proportionately two to four times more expensive. It is in these higher grades, which are sometimes essential for specific purposes, that the greatest shortage exists.

Sheldon Booth, president of the Diamond Tool Company, Chicago, Ill., explains the method of grading used by his company as follows: Common quality—one big diamond, rough, all diamond, no special shape or special density guaranteed; Medium quality—diamonds which possess either special shapes for special purposes, or special grain density without the special shape, not both; Select quality—stones which are of the special density and special select shapes (both.)

Mr Booth points out that it is the crystal which cuts, and not the contour of the stones. It is his contention that many buyers specify medium and select quality stones solely because they believe they are securing a diamond with much longer life and consequently believe they are getting more value for their money. Actually the reverse is true and Mr. Booth states that it is sounder economy in most of such instances to use common quality diamonds which, if bought in proper sizes in proportion to the grinding wheels to be dressed, will do fully as good and often a better job, and last longer, if they are wisely used and reset at frequent intervals. This matter of frequent resetting is extremely important for it will do more than anything else to prolong life of the diamond. Mr. Booth recommends such a buying policy as tending to insure prudent utilization of the available supply of common quality diamonds and definitely conserving the diminishing supply of the scarcer, more expensive grades. In this connection, he mentioned that the outstanding consideration in purchasing diamonds of a lower grade against those of a higher grade for straight dressing purposes is that the lower grade diamonds must be bought in larger sizes as the crystals are not so closely knit.



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Planned Economy

(Continued from page 15)

the fiscal years 1934 to 1937, inclusive, the percentage was 10.33. In 1939 it was only 13.75, which was less in proportion than the amount spent on the average in the four years before 1933 and even in 1940 it was 18.2 or less than it was in 1929, 1930 or 1931.

If our leaders saw clearly ten years ahead and knew what was coming, how is it that the construction of no new battleships was actually started between 1933 and late 1937 and only two such ships were added to our Navy in

the four years following immediately before Pearl Harbor? If our leaders had been able to foresee four years before that catastrophe the developments which disastrously materialized and led us inextricably up to it, our President could not with conviction and confidence have said as he did in 1937, "We shall soon . . . have, at the same time, a balanced budget that will include provisions for the reduction of the public debt." Nor could we have added a few months later in referring

to the threat of bankruptcy which seemed to face those nations which were engaged in an armament race, "In proportion to national budgets the United States is spending a far smaller proportion of government income for armaments than the nations to which I refer. It behooves us, therefore, to continue our efforts to make both ends of our economy meet."

What we have done in the past ten years with regard to our own internal economy gives us further evidence of the almost certain fallibility of economic planning in the sense that that term is being used here. Consider our killing of little pigs, our burning of wheat, our purchase of scarcity by paying farmers not to raise this or that. Consider, too, our erratic war-time rationing with too little of something now and too much of it a little later, or too much of it now and too little a short time hence. And keep in mind that one part of the job, the adequate feeding of our people, which our planners would have our so-called master minds do for us normally, is, as it is practiced currently, short-range stuff.

Go back to the New Deal depression days and count the plans that did not work, looking particularly at those that were designed to put an end to unemployment, an eventual accomplishment which cannot be credited to the planners, but must be attributed to the war which they did not foresee.

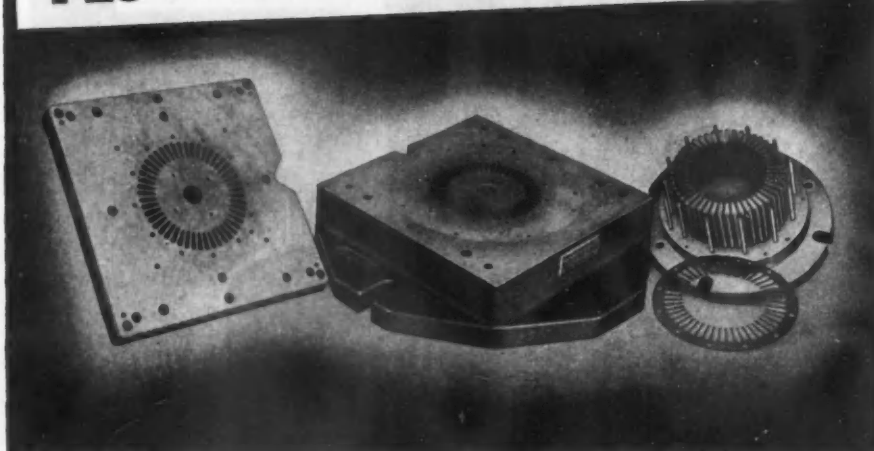
From the war we have learned that the planners cannot see the big things that are coming. From our experience in recent years with attempts to plan our internal economy, we have learned that they cannot see the relatively little things either. Omniscience is not a human characteristic.

Senator Barkley in his fourth-term nominating speech in direct contradiction of the first two paragraphs of Section III of his party's 1944 platform, summed up tersely and confirmed this part of the argument by saying, "When the treachery of Pearl Harbor came, we were not ready."

Successful long range national economic planning calls not only for superhuman wisdom, but also for superhuman worthiness and integrity. For the latter assertion there is the support of Franklin D. Roosevelt in words uttered when, as an ardent verbal champion of simplified government and an outstanding exponent of states' rights, he was Governor of New York. It was in the year 1930 that he said:

"The doctrine of regulation and legislation by 'master minds,' in whose judgment and will all the people may gladly and quietly acquiesce, has been too glaringly apparent at Washington during these last ten years. Were it possible to find 'master minds' so unselfish, so willing to decide unhesitatingly against their own personal interests or private prejudices, men almost God-like in their ability to hold the scales of justice with an even hand, such a government might be to the in-

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terest of the country, but there are none such on our political horizon, and we cannot expect a complete reversal of all the teachings of history."

And that, since he himself was on the national political horizon at that time, would seem to clinch the balance of the argument.

WPB Takes Step Toward Reconversion

(Continued from page 50)

amended to achieve better cohesion with the spot procedures. The following are the orders applying specifically to automotive products:

L-158, Automotive Replacement Parts; L-180, Replacement Storage Batteries; L-270, Automotive Maintenance Equipment; L-314, Lubrication Equip-

ment; and L-201, Automotive Tire Chains, Tractor Tire Chains and Chain Parts.

Conservation orders controlling the use of aluminum, magnesium, copper, quartz crystals, iron and steel, lead and zinc are subject to the spot procedure. Until they have been amended, the new

procedure grants relief only from the prohibitions against the use of materials.

WPB has promised that other items will be added to the permitted list as rapidly as possible. WPB will also give a preference rating of AA-5 to get materials for the production of items, which the Office of Civilian Requirements deems essential to the civilian economy, provided the other conditions of PR 25 have been met. This essentiality list covers all functional automotive replacement parts; tire chains, tractor tire chains and chain parts; automotive maintenance equipment for shops and garages (passenger car jacks, tire gauges, automotive tire pumps, tire tools); all items of lubrication equipment; and blow torches. In addition, under the steel and copper conservation orders the same priority assistance will be given for watches.

There are five specific points of policy which applicants should take into consideration in filing for permission to manufacture goods. They are:

1. Authorization to produce will in no case be granted if production will in any way interfere with either war production or the production of essential civilian articles.

2. The labor and facilities to manufacture must be available to the applicant and not required for more essential purposes: The applicant will be denied if the applicant's proposed use of labor would interfere with local and inter-regional recruitment of labor.

3. In general, more favorable consideration will be given to applications where the articles can be produced from idle, excess or frozen materials and components, whether in the applicant's inventory or available from others, than where new materials and components are required.

4. Preference ratings of AA-5 will be assigned but only for the production of utility items of importance in civilian requirements. A list of these items can be obtained at your nearest local WPB field office. In general, more favorable consideration will be given to applications for the production of these items.

5. Before making application, the applicant should investigate the supply situation of the materials and components which he will require. In general, more favorable consideration will be given to applications where the new materials needed to produce the product can be readily obtained with an AA-5 rating (if a utility item) or without a rating.

Idle and excess inventories, which may be used for civilian production under the new regulation, are reported to regional offices which maintain lists of such materials and products. Information as to types of materials available may be obtained from WPB regional offices, which will try to bring buyers and sellers together, so that maximum use of these stocks can be made under the new program.



Standard Among Engineers for Sixty-Three Years

EXPERIENCE in the manufacture of TUTHILL Springs—with superior Quality the object—means constant advancement in methods, processes and ideas in Spring production. Four distinct steps are taken to insure TUTHILL Quality:

1. **Material Control.** Each shipment of steel from which Tuthill Springs are made is inspected to insure its conforming to S. A. E. standards based on chemical analysis.
2. **Superior Heat Treatment,** pyrometer controlled, secures right tempering, correct hardness, toughness and resilience. Continuous heating and tempering furnaces, modern thruout, temper and toughen Tuthill Springs.
3. **Shot Blasting.** New conveyor type of Shot-peening equipment is used to give added strength, resistance to wear, heavy loads and rough usage, and to prolong life with less fatigue.
4. **Experience.** Sixty-four years of constant progress in improved methods and heat treatment insures exceptional performance under all load and service conditions.

TUTHILL manufactures a complete line of standard leaf-type springs; also makes to order special types of springs to meet your specifications. Advise your requirements and let our engineers submit specifications, with recommendations.

Submit your Spring problems with details

TUTHILL SPRING COMPANY

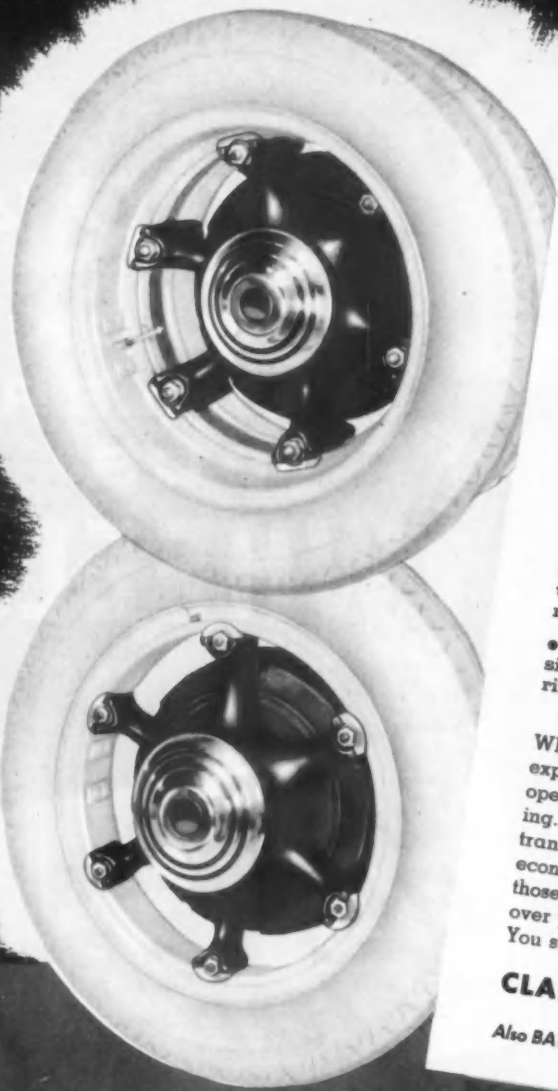
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CHICAGO 7, ILLINOIS

CLARK TRUCK TRAILER BUS WHEELS

Built to do a
BETTER
★ **JOB** ★

EXCLUSIVELY CLARK—AN INGENUOUS DUAL TIRE MOUNTING ASSURES
CONSTANT TIRE ALIGNMENT, ADDING MANY MILES TO TIRE LIFE . . . WITH
CLARK'S PATENTED RIM LUGS AND MOUNTING, AN ORDINARY LIGHT WRENCH
MAKES A TIGHT ASSEMBLY . . . STRONGER YET LIGHT IN WEIGHT—THE
BIGGER THE WHEEL, THE GREATER IS THE PROPORTIONATE WEIGHT
REDUCTION . . . SCIENTIFIC AIR COOLING CONSERVES BRAKES,
DRUMS AND TIRES . . . UNIT CONSTRUCTION ELIMINATES PARTS THAT
LOOSEN—A COMMON CAUSE OF WHEEL FAILURE . . . DEMOUNTABLE
RIMS—NO EXTRA WHEEL TO CARRY—ONLY A SPARE RIM . . .

Another
PRODUCT of
CLARK
EQUIPMENT
COMPANY



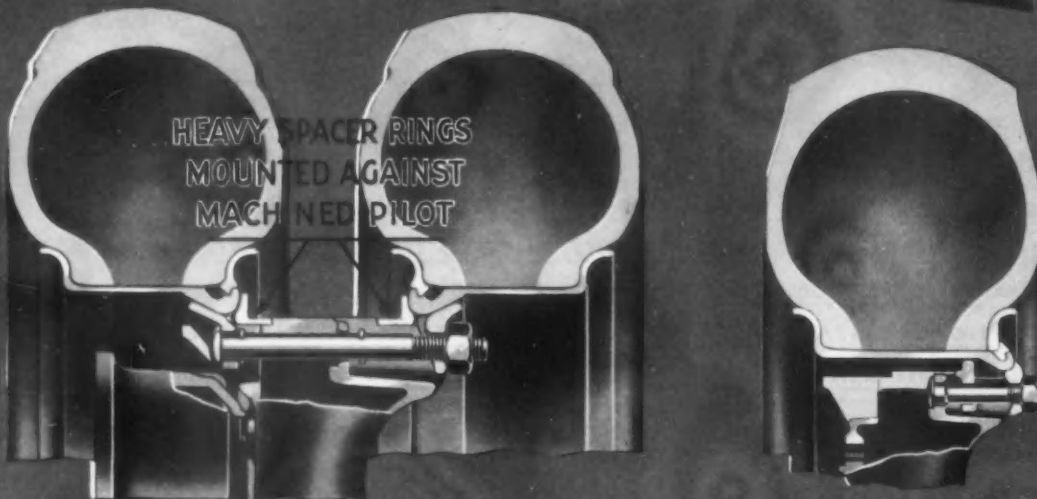
BETTER WHEELS AND BIGGER SAVINGS

Think of these advantages in terms of your own operating costs —

- Dual tires held solidly in proper alignment: Clark's exclusive mounting makes sure of it.
- Spoke wheels and the Clark method of tire spacing provide thorough ventilation—prevent the overheating of tires, brakes and drums.
- Considerably less unsprung weight, due to lighter wheels and to carrying a spare rim instead of a spare wheel.
- Easy interchangeability of dual and single rear mountings, with a variety of rim sizes.

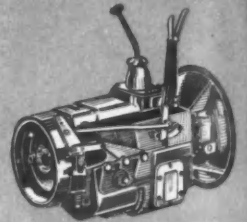
These and many other features of Clark Wheels, are natural built-in results of Clark experience, of knowing the needs of economical operation, and of capable, resourceful engineering. A good many experienced operators are translating these advantages into important economies. A sensible step toward effecting those economies in your own business is to talk over your wheel problems with Clark engineers. You say when?

CLARK EQUIPMENT COMPANY
BUCHANAN, MICHIGAN
Also BATTLE CREEK, JACKSON, BERRIEN SPRINGS, MICH.

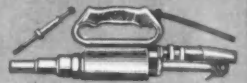


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Some
CLARK
products



TRANSMISSIONS



BLIND RIVETING PROCESS



AXLE HOUSINGS



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FOR TRUCKS AND BUSES



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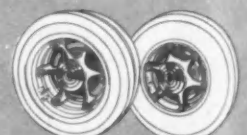
ELECTRIC STEEL CASTINGS



INDUSTRIAL TRUCKS
AND TRACTORS



RAILWAY CAR TRUCKS



METAL SPOKE WHEELS

American's Complete Broaching Service

Solving Production Problems of War

... Ready to Plan for Peace

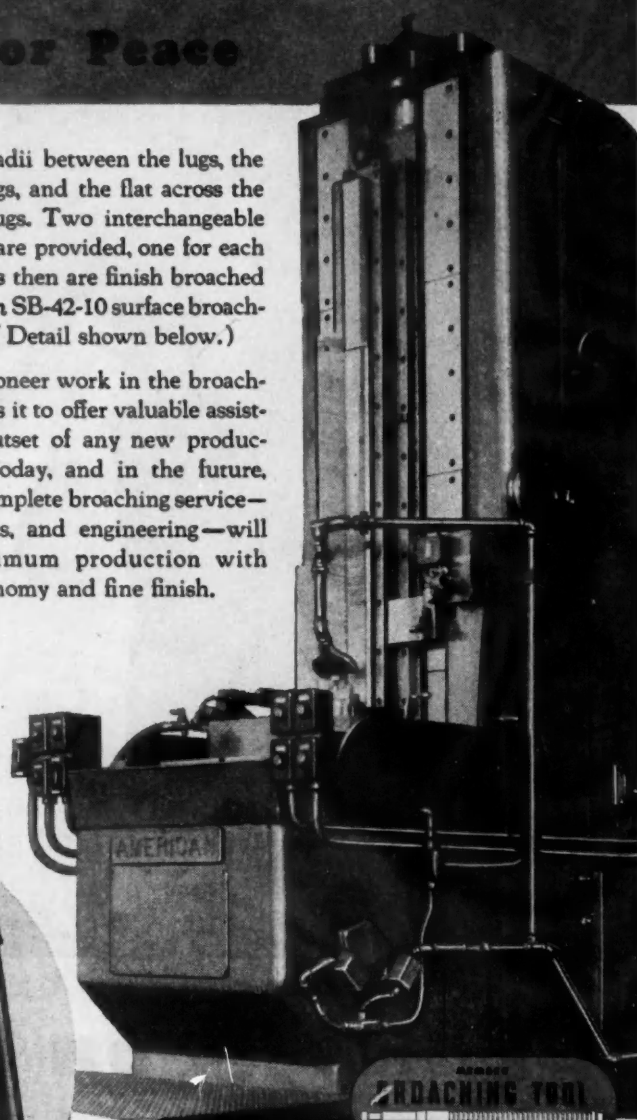
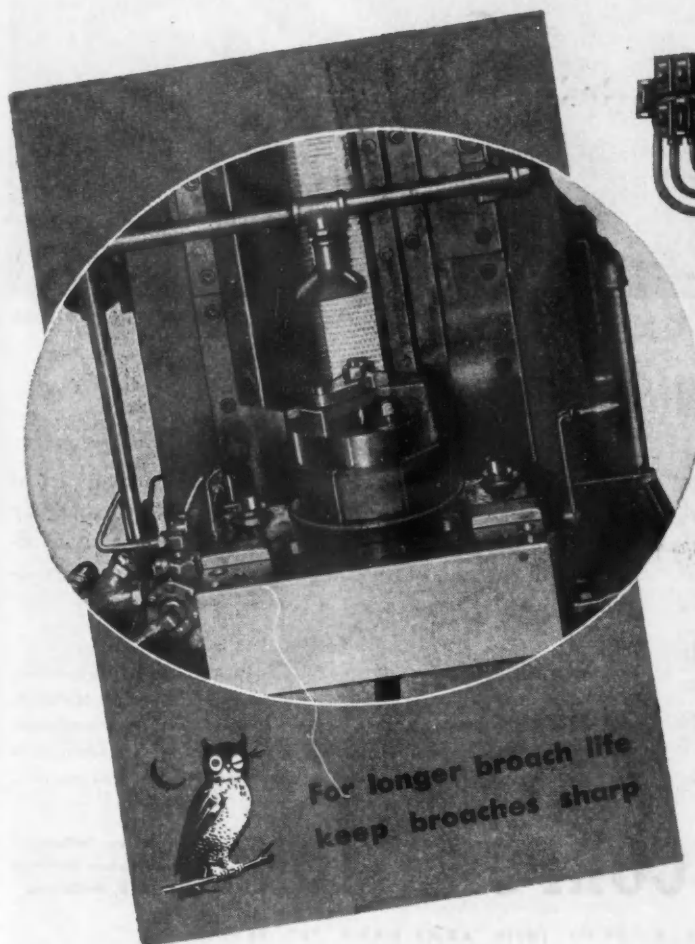
The advantages of broaching by *American* are well known to the Nation's leading manufacturers. Almost every war industry has made use of broaching, the *American* way, to secure fast, accurate, economical output.

For example, American Broach and Machine Company engineers recently designed the broach tooling and setup for the production of a new aircraft part. One operation entails the finishing of the external contour of a two-part stop sleeve.

An American SB-66-15 surface broaching machine (shown at the right) rough

broaches the radii between the lugs, the sides of the lugs, and the flat across the index of the lugs. Two interchangeable tooling setups are provided, one for each part. The parts then are finish broached on an American SB-42-10 surface broaching machine. (Detail shown below.)

American's pioneer work in the broaching field equips it to offer valuable assistance at the outset of any new production effort. Today, and in the future, *American's* complete broaching service—machines, tools, and engineering—will provide maximum production with maximum economy and fine finish.



American
BROACH AND
MACHINE CO.

ANN ARBOR, MICHIGAN

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY





Buy More War Bonds

Precision for Sale!

Because of the unusual demands of war, Allied Products created new facilities. Plants were converted—personnel was trained. But the basic requirement . . . the habit of precision . . . was already there—an integral part of the Allied organization since its beginning.

Allied craftsmen are making a variety of large and small close-tolerance parts for machines of war. Among them are gun parts and aircraft engine parts machined to within limits of two ten-thousandths of an inch . . . and they are being produced in considerable volume.

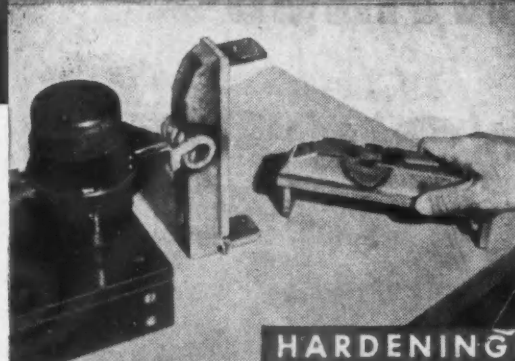
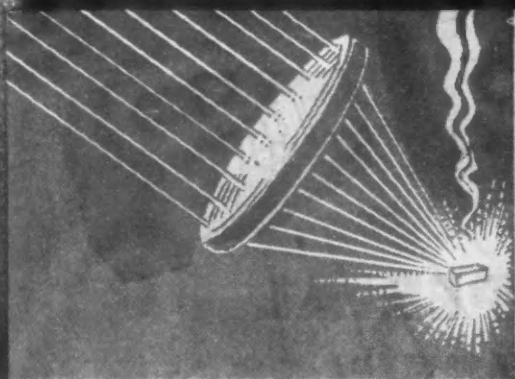
Enlarged facilities and a wealth of experience earned in years of peace and war will be available to industry for peacetime production. If you require precision hardened and ground parts coupled with production experience, let's talk it over. *We have precision for sale!*

"IT'S AN ALLIED PRODUCT!" . . . Allied Products Corporation and its divisions, Richard Brothers and Victor-Peninsular, in Detroit and Hillsdale, Michigan, also make: Sheet metal dies, from the largest to the smallest; steam-heated plastic molds; jigs and fixtures; the original, patented R-B Interchangeable Punch and Die; cap screws; cold forged parts; and other special products.

ALLIED PRODUCTS CORPORATION

Executive Offices:
4646 Lawton Avenue
Detroit 8, Michigan

ALL FOUR PLANTS HAVE NOW ADDED A STAR TO THEIR ARMY-NAVY "E" PENNANTS



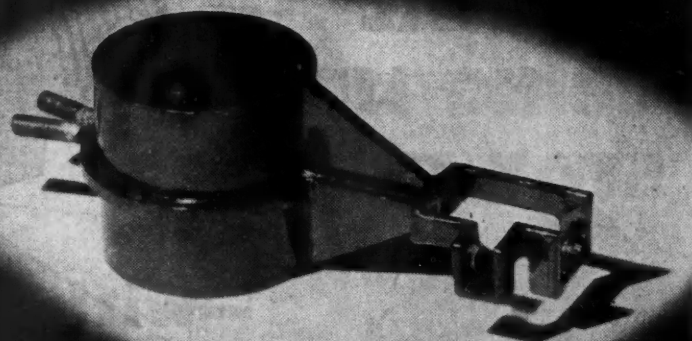
HARDENING



BRAZING



FORGING



Focused Heat

with **AJAX-NORTHROP**

The little coil pictured above focuses 6 kilowatts of high-frequency current into a small complicated joint, and produces perfectly brazed bourdon gauge parts at an amazing rate of speed — at low unit heating cost, with no distortion and no clean-up required.

Aptly named a focus inductor, the coil was designed by Ajax-Northrup engineers to control and accurately concentrate the heat — no need to heat the whole part just to braze one small joint.*

This particular coil may not fit your work, but suitable inductors or furnaces can be designed to do your production heating jobs with higher speed and quality. By simply changing inexpensive coils and jigs, you can do several operations with the same Ajax-Northrup equipment.

AJAX-NORTHROP *Engineering*

For over a quarter of a century Ajax-Northrup engineers have successfully solved hundreds of heating problems with focused high-frequency heat.

We may already have solved problems similar to yours. Call on the full weight of our experience to help you revolutionize your production heating and melting for war now and for peace later.

AJAX-NORTHROP **HIGH-FREQUENCY**

AJAX ELECTROTHERMIC CORPORATION • Ajax Park

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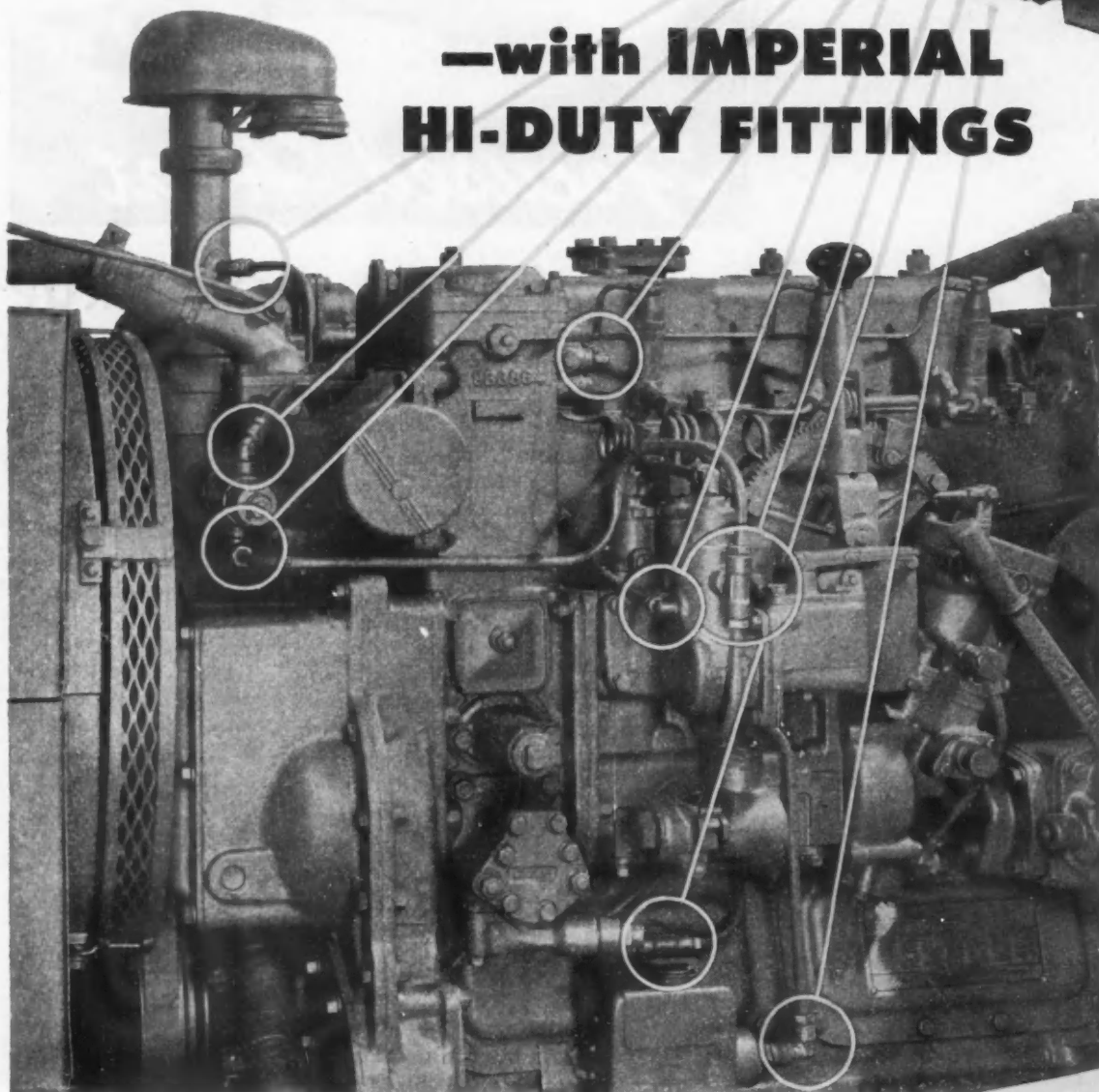
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MELTING

VITAL TUBING LINES STAY TIGHT

—with **IMPERIAL
HI-DUTY FITTINGS**



★ A well-known tractor manufacturer sought a tube fitting that would simplify assembly of tubing lines, assure tight joints and eliminate vibration breakage in the field.

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Hi-Duty is just one of many fitting types offered by Imperial. On your tubing connection problems, Imperial's broad experience can often be of assistance.

Bulletin 3101 covers several Imperial Fittings, including Hi-Duty. Write for your copy.

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1241 W. Harrison St. • Chicago 7, Illinois

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★ *headquarters for tube fittings*

COMPRESSION, S.A.E. FLARE, INVERTED FLARE, HI-DUTY, FLEX
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VALVES • FUEL STRAINERS • TUBE WORKING TOOLS

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The coating on PAGE Shielded Arc Electrodes is constantly checked for uniformity

THE UNIFORM COATING ON **PAGE-Allegheny** STAINLESS STEEL ELECTRODES HELPS YOU CONTROL STAINLESS WELDS

Certainly the analysis of the rod and the type of coating are vitally important in controlling stainless welds. PAGE went to the world's largest producer of stainless steel to make certain that PAGE-Allegheny STAINLESS STEEL ELECTRODES would be right.

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HI-TENSILE "C" ELECTRODES • For vertical, overhead or horizontal welding of carbon steels, PAGE recommends HI-TENSILE "C" SHIELDED ARC ELECTRODES. These electrodes can be depended upon for welds that pass rigid tests for tensile strength, elongation, resistance to impact and fatigue. Ask your local PAGE distributor for specific information.

PAGE STEEL AND WIRE DIVISION

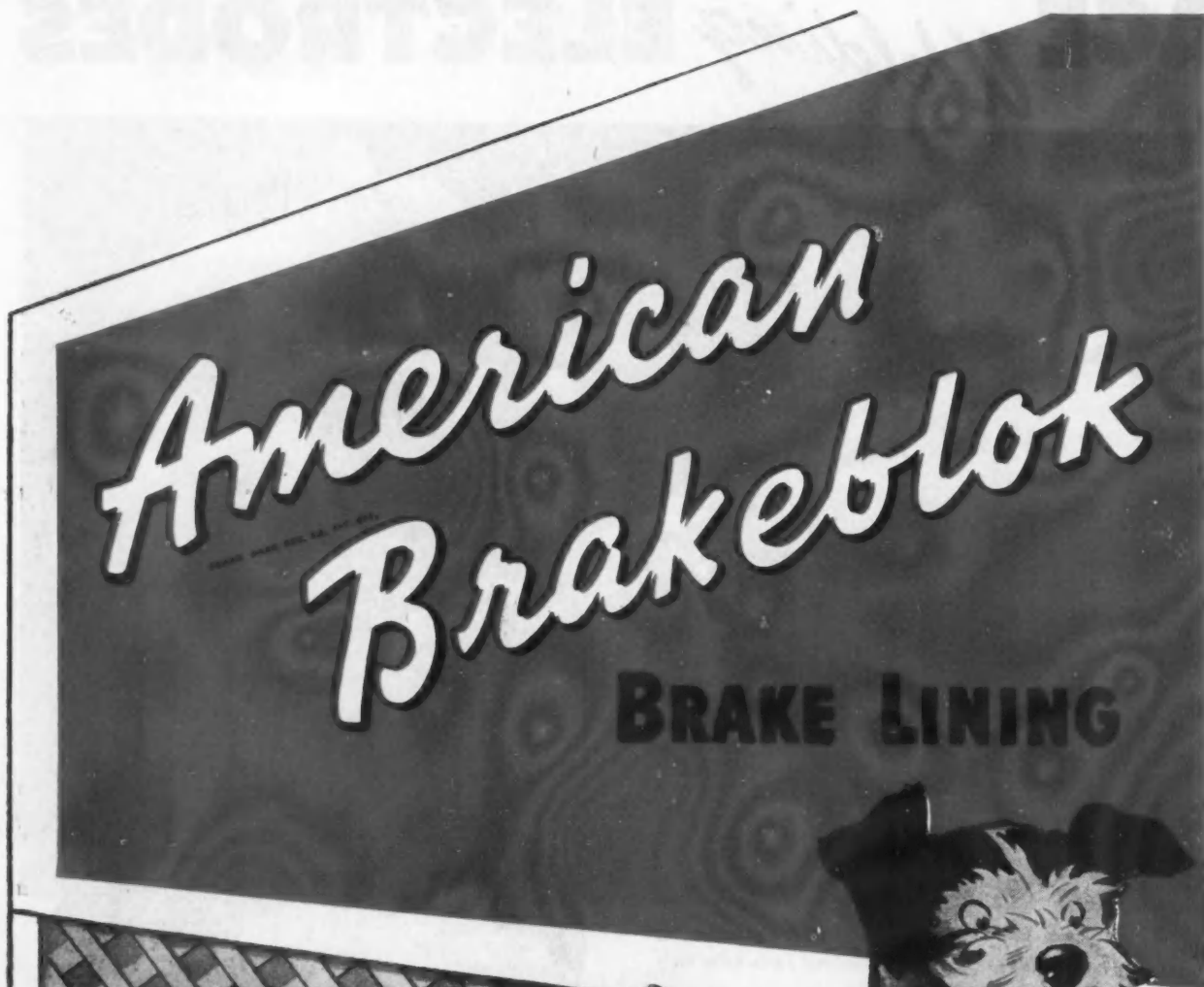
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AMERICAN CHAIN & CABLE COMPANY, Inc.

BRIDGEPORT • CONNECTICUT



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All Safely"**

- says Stopper



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Master stocks in 38 NAPA warehouses. Jobbers everywhere
give prompt service.

BAKER

*Single and Multiple
Spindle* UNIT

DRILLING • BORING • TAPPING
MACHINES

For Post-War Economies

With the close of the present struggle, and the return of Manufacturers to peace-time production, the problems of re-tooling and cost reductions will be among their chief concerns.

Those manufacturers who are at present tooled with BAKER automatic cycled multi-operation machines will be fortunate indeed, because BAKER machines are flexible—they can be quickly converted from War-time operations to Peace-time production.

The machine illustrated is but one of many designs. If we don't have the machine your operations require we'll design it. Let the BAKER Engineering Department solve your drilling, boring, and tapping problems.

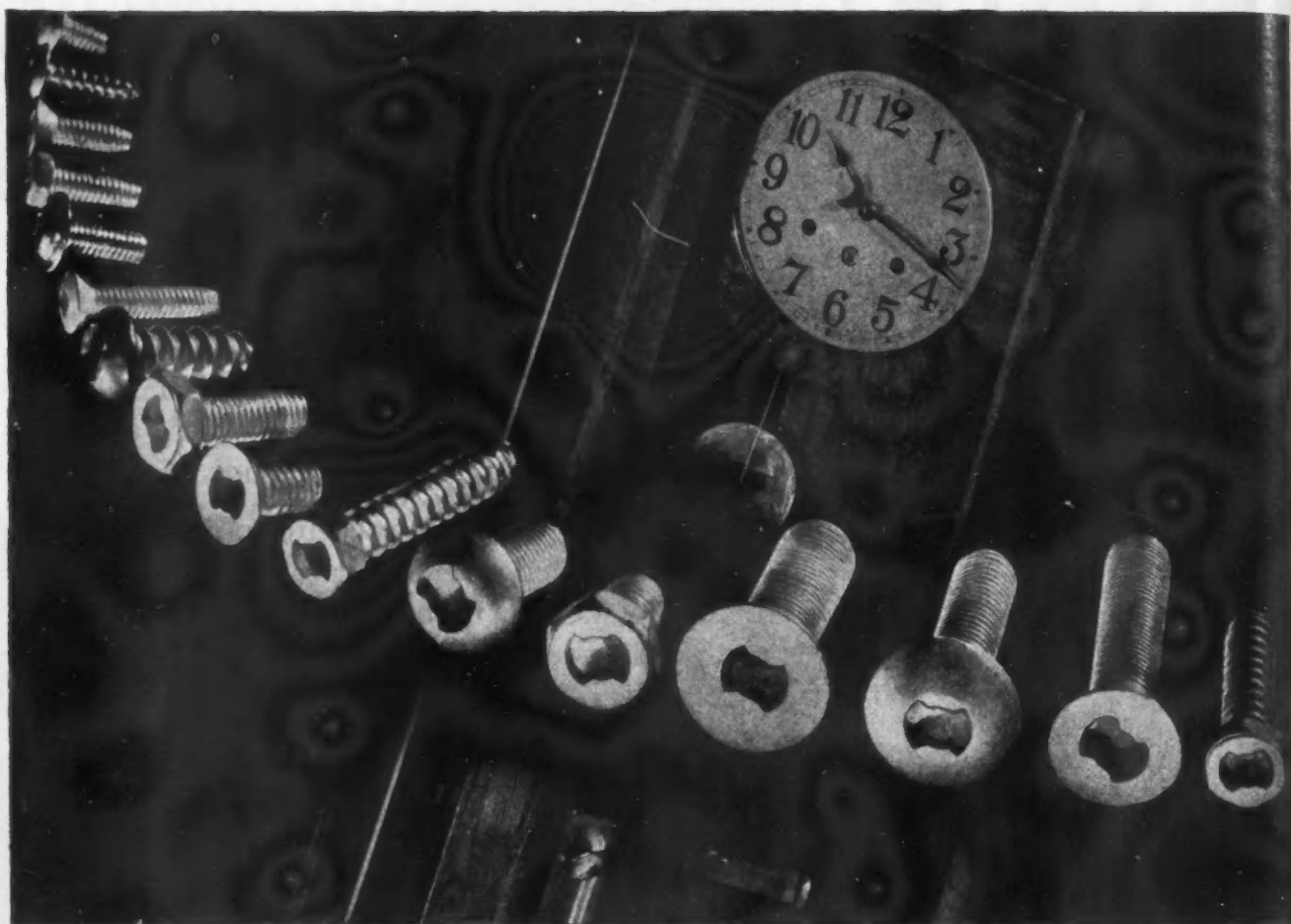
★

The machine illustrated was built up of three standard SA12 self-contained hydraulic feed units and one special multiple spindle tap unit mounted around a 30" diameter five station hand index table. This machine was built for one of our leading automotive manufacturers of transmissions. The machine is fully automatic in cycle and each of the spindles of the taper unit was furnished with individual lead screw and nuts—with the taper heads direct coupled (motor driven) with provision for reversing motor for backing tap out of hole. Production: 130 per hour.

The units are mounted on a fabricated welded steel bed which can be removed and used in building up other types of multi-operation machines.



BAKER BROTHERS, INC., Toledo 10, Ohio, U. S. A.



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Time is adamant. It measures the output . . . *and the cost* . . . of production. For several definite and easily provable reasons you will find that CLUTCH HEAD Screws pace Assembly Line production at every step.

The testing and proving of these time-saving features . . . plus others that contribute to smoother, safer operation and lessened fatigue . . . may be done right at your own desk. To this end, your request will bring you, *by mail*, a package assortment of CLUTCH HEAD Screws and sample Type "A" Bit, along with fully illustrated Brochure.

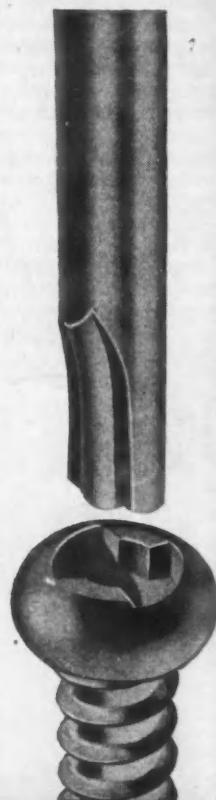
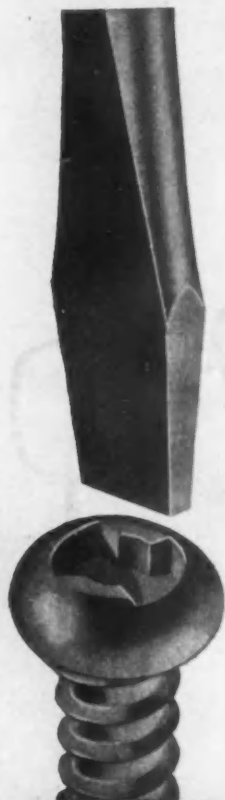
Your own appraisal will show you that this modern screw has advanced engineering design to challenge the march of production time; that it has everything . . . *AND MORE* . . . offered by any or all other screws on the market . . . explanation enough why CLUTCH HEAD is accepted as "The Screw That Sells Itself."

You may order CLUTCH HEAD Machine Screws in regular and thread-forming types. Production is backed by this organization and by responsible Licensees.

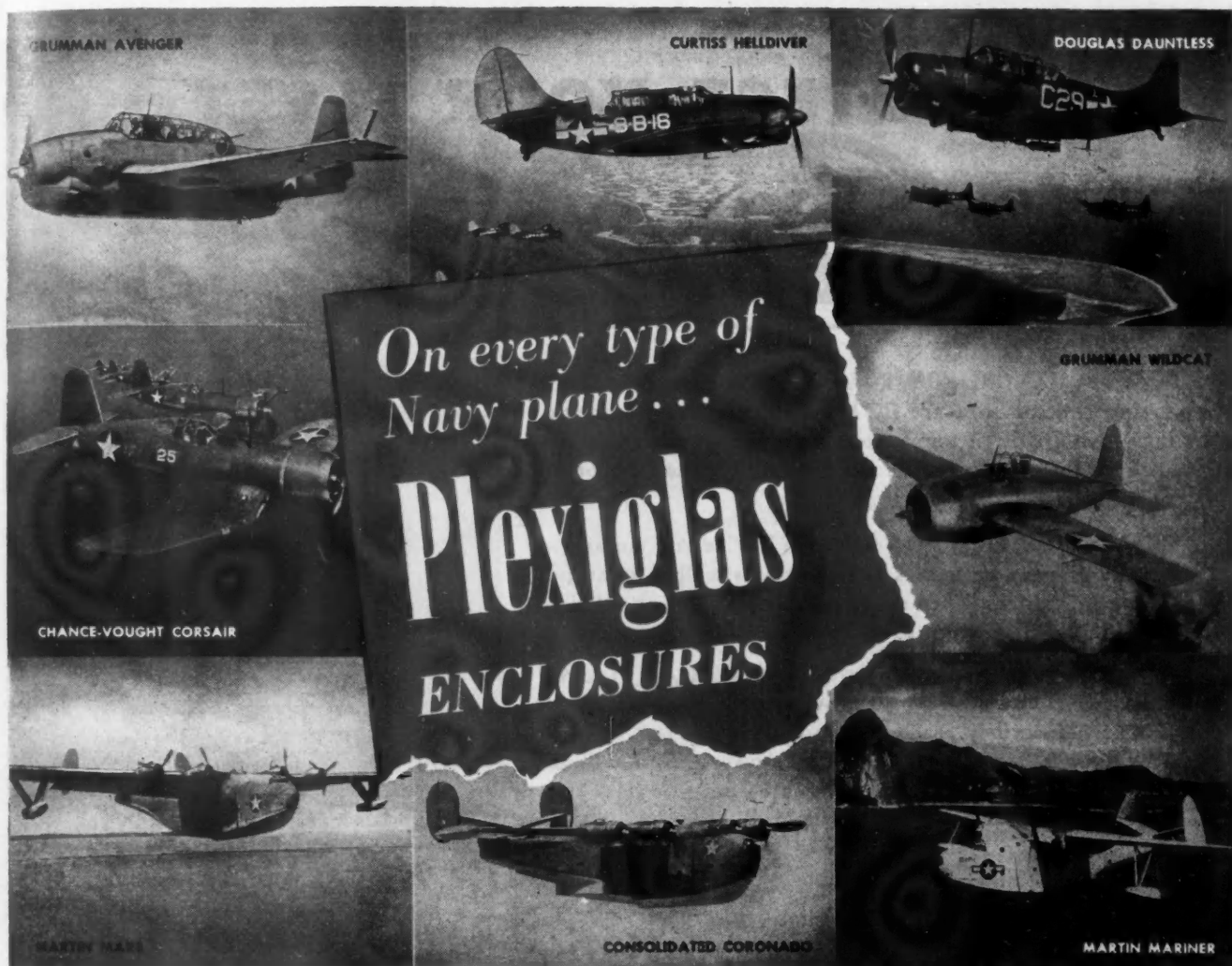
Check the perfect operation of this screw with an ordinary type screwdriver, or any flat blade, of proper width. This exclusive CLUTCH HEAD feature has proved its value in war and peacetime service.



This rugged Type "A" Bit is restored to its original high efficiency by a 60-second application of the end surface to a grinding wheel. No delay. No expense. No "back-to-the-factory" shipment for reconditioning.



UNITED SCREW AND BOLT CORPORATION
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Strong, light, and permanently transparent, this Rohm & Haas acrylic plastic has convincingly demonstrated its advantages in eight years of flying under all weather conditions. Today, PLEXIGLAS is seeing active service on every type of Navy plane. In nose sections, gun turrets, cockpit

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Only Rohm & Haas makes PLEXIGLAS

PLEXIGLAS is the trade-mark, Reg. U. S. Pat. Off., for the acrylic resin thermoplastic sheets and molding powders manufactured by Rohm & Haas Company
Represented by Cia Rohm y Haas, S.R.L., Carlos Pellegrini 331, Buenos Aires, Argentina, and agents in principal South American cities.

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Manufacturers of Chemicals including Plastics... Synthetic Insecticides... Fungicides... Enzymes... Chemicals for the Leather, Textile and other industries

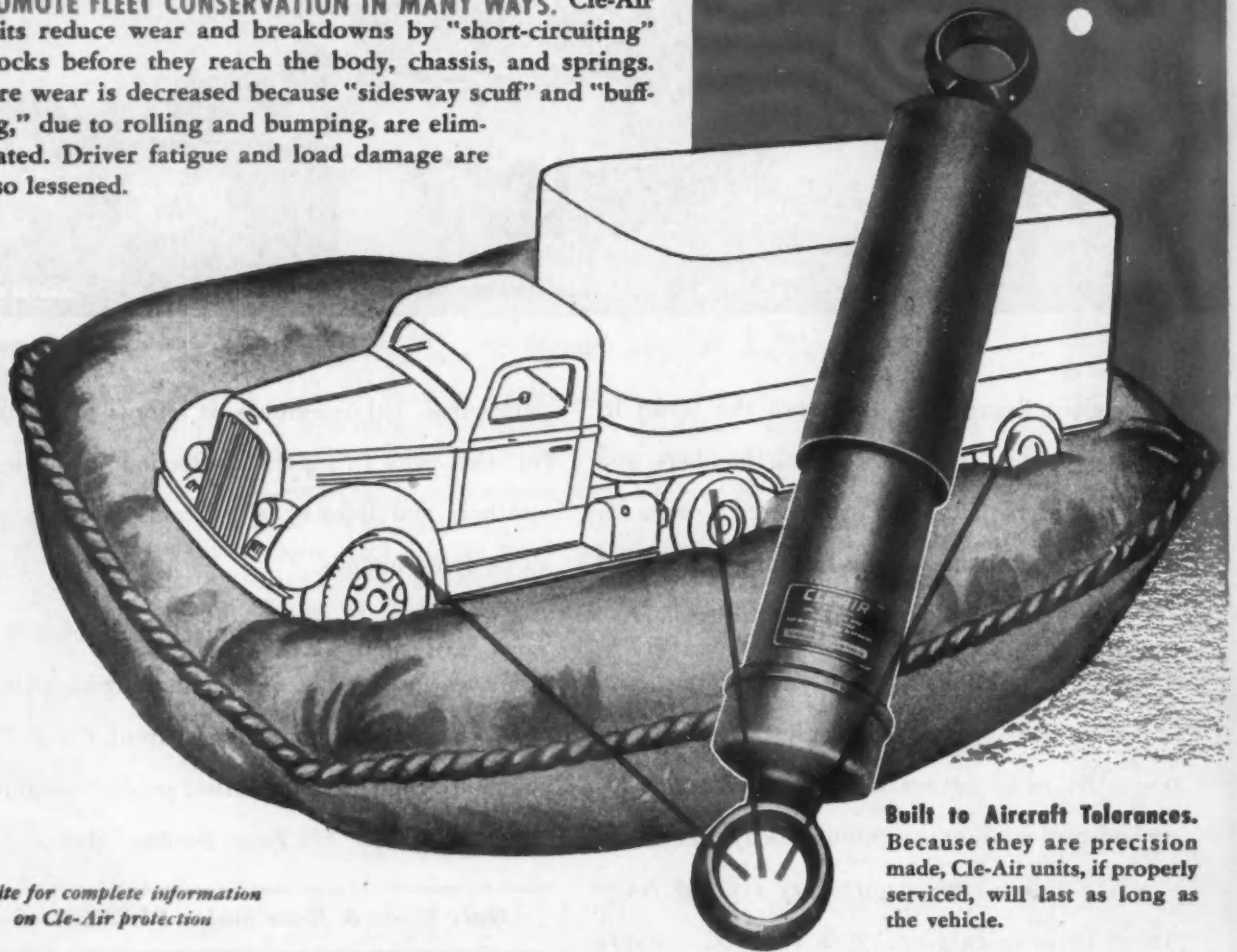


PROTECT YOUR FLEET WITH A *Cushion* OF AIR AND OIL!

DUAL-PROTECTION FROM ROAD SHOCKS. Because Cle-Air spring control units are BOTH hydraulic and pneumatic, they give a ride of unmatched smoothness. Air resiliency absorbs the shocks, while the hydraulic resistance of oil prevents recoil.

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PROMOTE FLEET CONSERVATION IN MANY WAYS. Cle-Air units reduce wear and breakdowns by "short-circuiting" shocks before they reach the body, chassis, and springs. Tire wear is decreased because "sidesway scuff" and "buffing," due to rolling and bumping, are eliminated. Driver fatigue and load damage are also lessened.



*Write for complete information
on Cle-Air protection*

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THE CLEVELAND PNEUMATIC TOOL COMPANY
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CLE-AIR *Spring* **CONTROL UNITS**

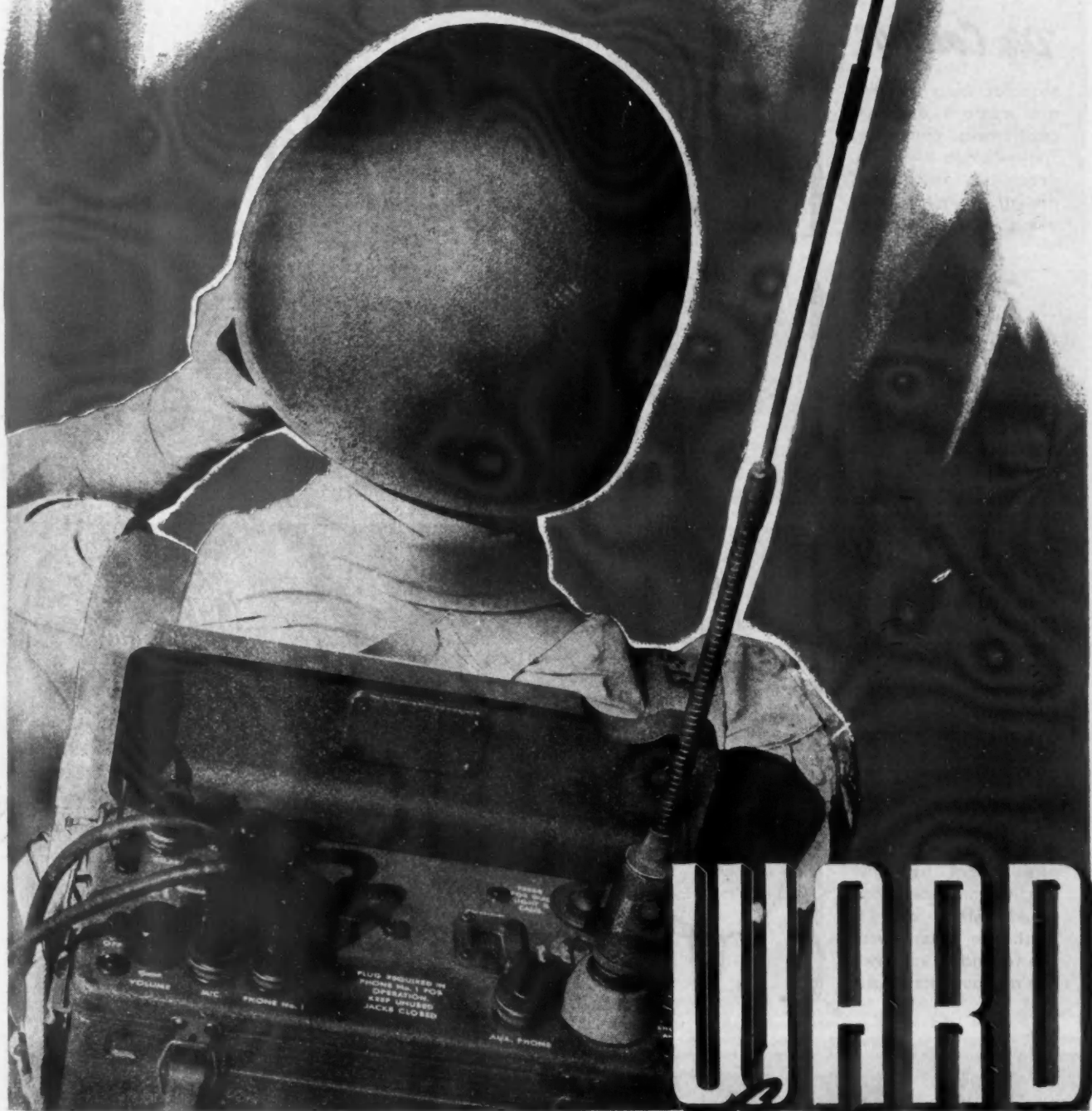
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Yesterday, **WARD** antennas were found on most of the peacetime automobiles, radios and portable radios.

All of the manufacture of antennas and radar equipment of **THE WARD PRODUCTS CORPORATION** is, today, going entirely to the war effort and being used on all fighting fronts.

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WARD

Antennas

THE WARD PRODUCTS CORPORATION



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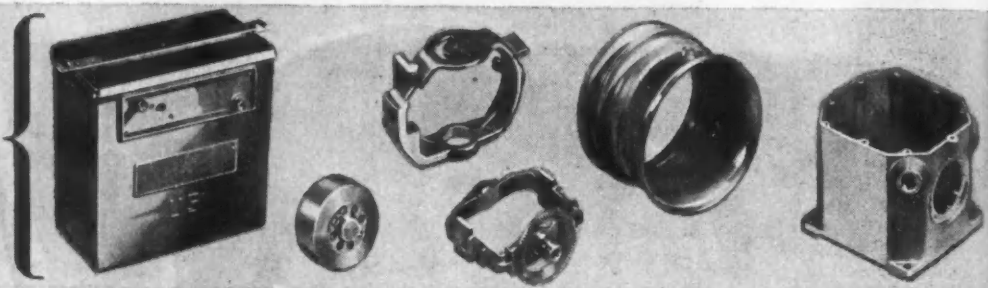
115



If it rolls-if it

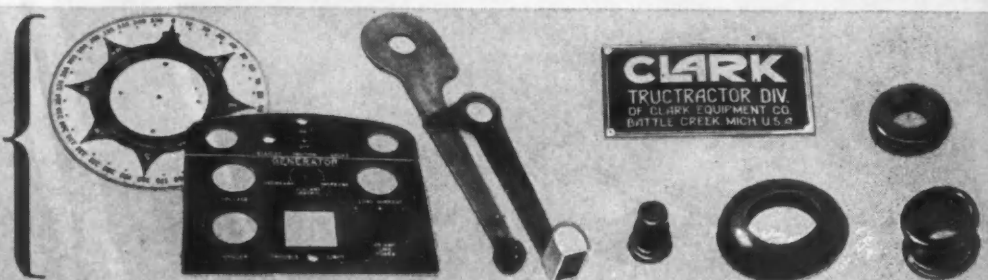
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Manufacturing facilities are modern and exceptionally complete. They include trimming, precision machining, plating, painting, cranking and anodizing.



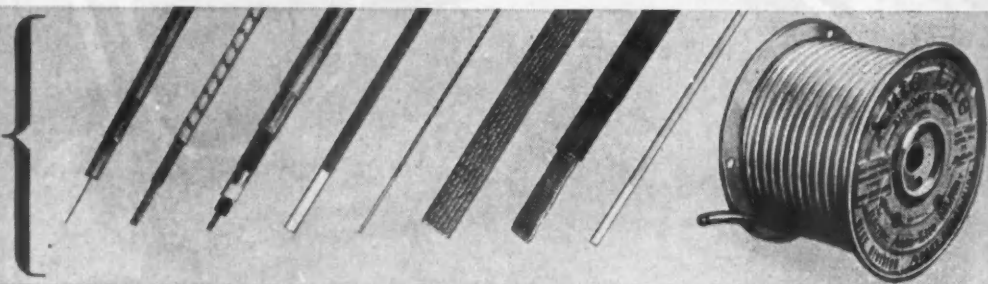
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All-plastic products, metals and plastic-metal combinations with various types of ornamentation are produced entirely under one roof at the Bay Division.



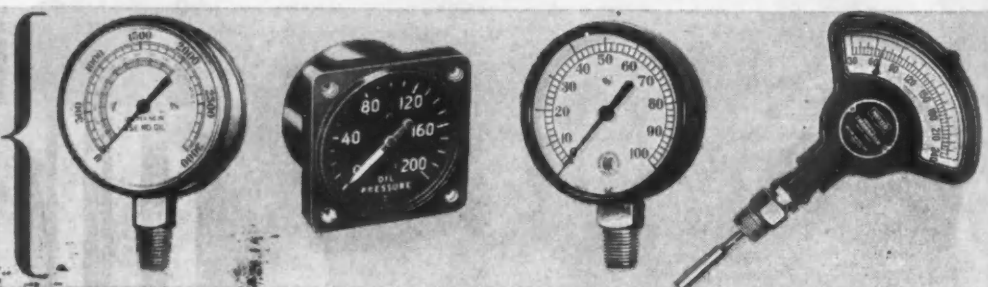
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Wire and cable is available in a full range of sizes, shapes, materials and insulations including heat-resisting Vega Chromoxide enamel and other special types.



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A wide range of pressure gauges, tachometers, thermometers and speedometers, etc., is available from Auto-Lite for industrial, aviation and automotive use.



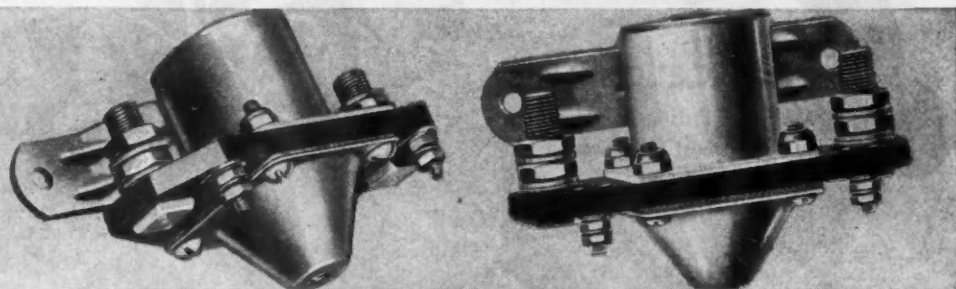
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floats-if it flies-

AUTO-LITE CAN SERVE YOU

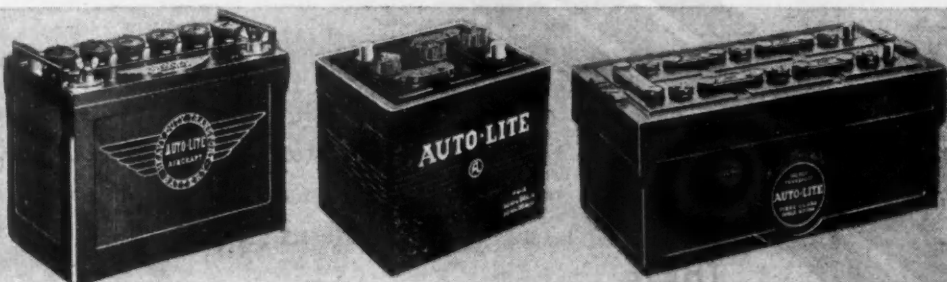
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Auto-Lite relays and switches are made for intermittent or continuous duty. In developing them, Auto-Lite combines the features of long life and low price.



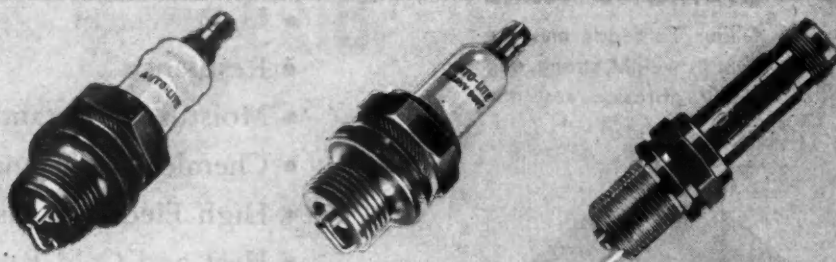
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Auto-Lite batteries are built in every type and size to fit various models of passenger cars, trucks, buses, stationary engines as well as aircraft.



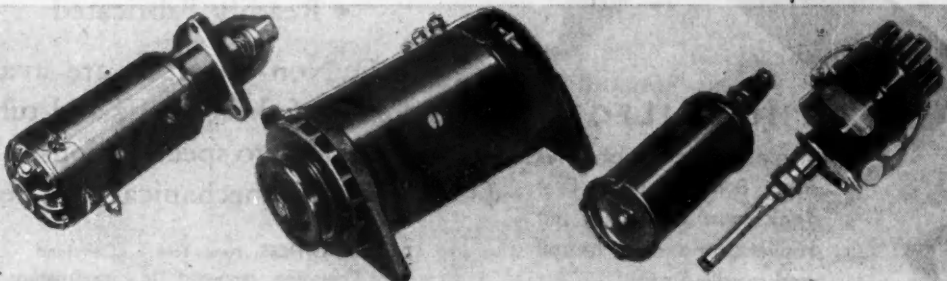
Spark Plugs

Auto-Lite spark plugs are designed for use in automobiles, trucks, buses and aircraft and are engineered to work in harmony with the complete ignition system.



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For thirty-three years Auto-Lite has been producing precision-built starters, generators, distributors and coils which are specified by many leading manufacturers.



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The products shown on these pages are applicable to many industries and are manufactured by: Die Castings Division . . . Bay Manufacturing Division . . . Wire Division . . . Instrument and Gauge Division . . . Battery Corporations . . . Automotive Division . . . Aircraft Division. For complete information, write to
TOLEDO, 1 THE ELECTRIC AUTO-LITE COMPANY OHIO

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THIS CELORON

Molded Plastic Gunsight Bracket must be light in weight, yet strong and tough.



THESE DIAMOND FIBRE

Glider Fairleads must be light in weight, strong, and highly abrasion resistant.



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Angle, used to brace baffles in a Bullet Sealing Fuel Tank, must be strong but resilient, and must be oil and gasoline proof.

CONTINENTAL-DIAMOND Non-metallic materials offer designers a wide range of desirable properties . . . controlled by C-D Engineering to meet specific electrical, mechanical and thermal problems.

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C-D Non-metallics are available in standard forms of sheets, rods and tubes . . . or in parts fabricated to specifications . . . for complete technical and mechanical data, send for Bulletin GF.

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Write for a FREE copy of the Exide catalog on Heavy-Duty Batteries. It gives you catalog data on how to order and how to get the most from your Exide Heavy-Duty Batteries.



THE ELECTRIC STORAGE BATTERY COMPANY
Philadelphia 32
Exide Batteries of Canada, Limited, Toronto

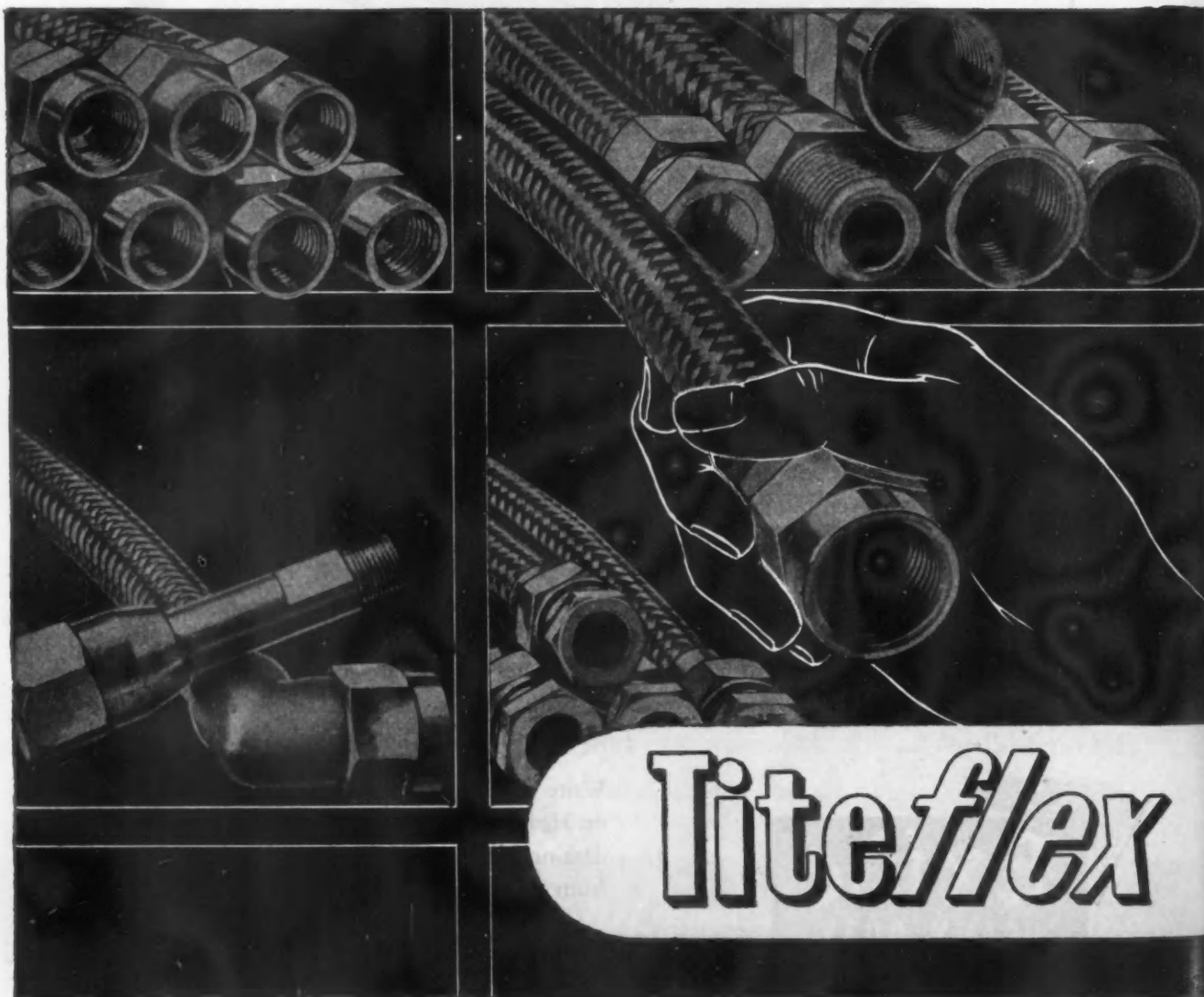
Long Life flexible lines for long Mileage transportation

YES — that pleasure car that travels on an "A" coupon may get by with inferior flexible tubing for fuel, oil, and air lines . . . But manufacturers and operators of heavy duty commercial vehicles *know* that Titeflex is the only flexible line that does not demand frequent replacement.

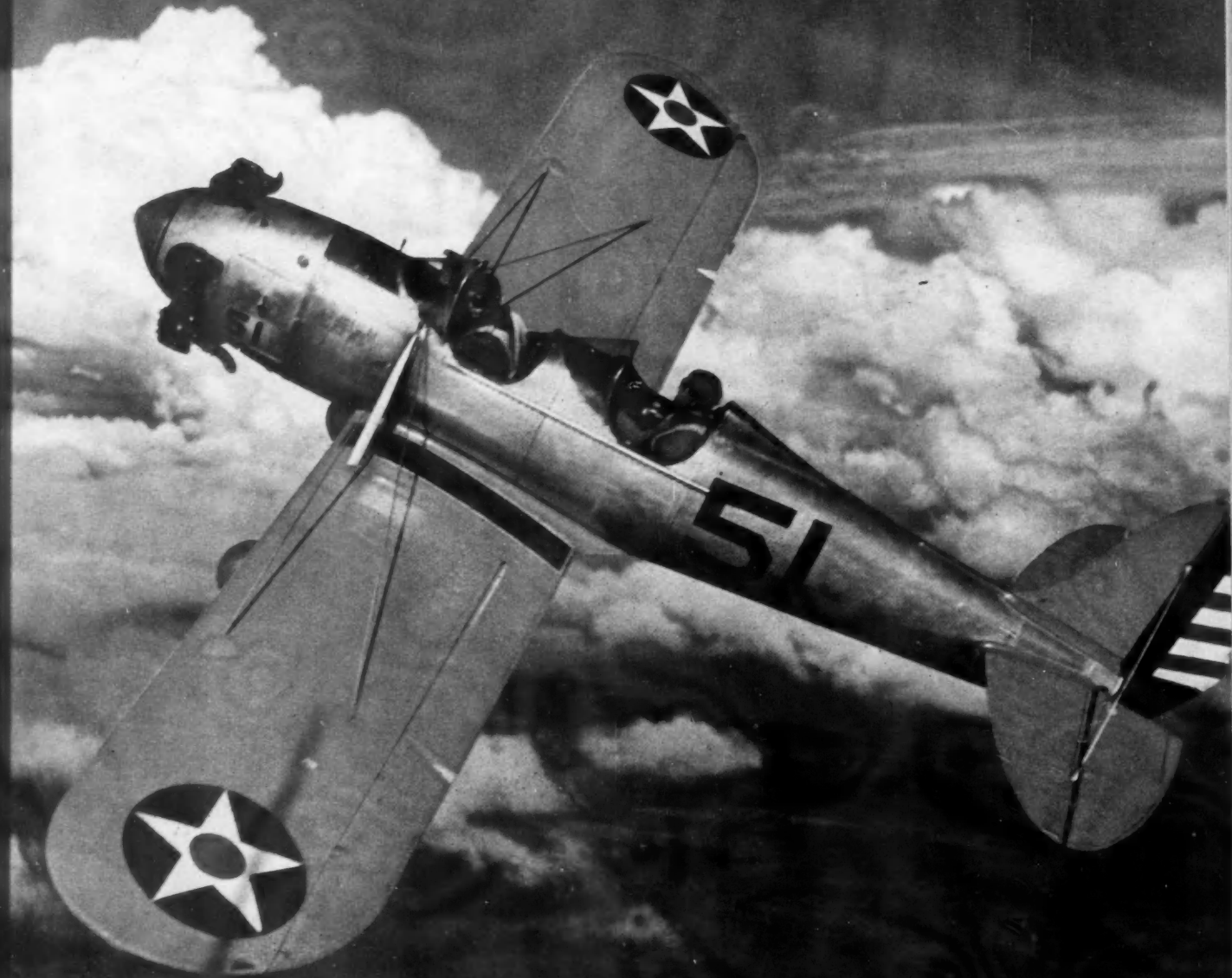
Today there are buses and trucks on the road that have travelled hundreds of thousands of miles. Such service would have seen ordinary flexible lines replaced many, many times, while in many instances the original Titeflex lines are still in service.

Why does Titeflex stand up? Because it is all-metal, yet flexible. Gasoline and oil cannot affect Titeflex. Heat and cold do not cause it to deteriorate. If Titeflex lines are not standard with you — just write, and we will gladly furnish other information. While direct war orders from Uncle Sam still are and will be first with us, we are doing our best to supply the essential commercial operators of automotive equipment.

TITEFLEX, INC.
507 Frelinghuysen Avenue
Newark 5, New Jersey



it is
can-
not
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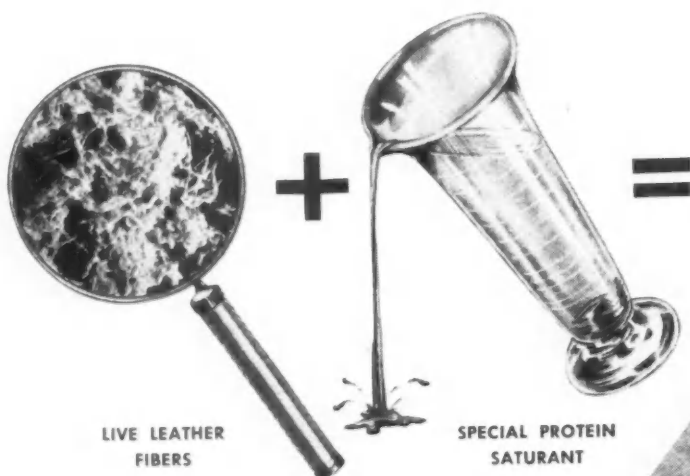
THEY *BANK* on *BOWLER*

In training planes, just as in every other class of fighting equipment, millions of Bower Roller Bearings are spinning day and night in every important combat zone.



BOWER
ROLLER BEARING CO.
Detroit, Michigan

This exclusive combination makes TOUGHER, MORE RESILIENT GASKETS*



* For sealing water, grease, gasoline,
or oil at temperatures up to 300° F.

ARMSTRONG'S NO. 841 Fibrated Leather sheet packing offers the excellent sealing properties of leather in large, uniform rolls and sheets. Made of live leather fibers saturated with a highly compatible protein binder, No. 841 is more resilient, more impervious to liquids, and more stable than vegetable fiber gasket materials. No. 841 is excellent for sealing transmission covers, transfer case covers, handhole covers, and for other applications that require a leak-proof joint between bolted flanges.

Armstrong offers also No. 1242, a low-priced,

general-purpose sheet packing. Armstrong's No. 143, a special noncorrosive sheet packing, is recommended for use with alloys of aluminum, magnesium, steel, zinc, or copper. For information and free samples, write Armstrong Cork Co., Industrial Div., 1509 Arch St., Lancaster, Pa.

Armstrong's No. 841 Fibrated Leather and No. 1242 Fiber Sheet Packing meet the following specifications: Federal E-HH-P-96a; U. S. Navy 33 P 22b; Underwriters' Laboratories, Inc. (for sealing hazardous liquids). Armstrong's No. 143 Fiber Sheet Packing meets Army-Navy Aeronautical Specification AN-HH-G-171.

ARMSTRONG CORK COMPANY

MATERIALS AND SPECIALTIES FOR



AIRCRAFT AND AUTOMOTIVE UNITS

- **Gaskets, packings, seals,** piston cups, bushings, and valve seats—for gauges, fuel lines, meters, hydraulic systems, and other equipment
- **Composition roll goods,** with or without fabric back, plain or adhesive-coated—used as glazing strip,

binding tape, cushion pads, anti-skid flooring, and gaskets

- **Tank strap cushions**

- **Sealing materials** for specialized aircraft equipment handling aromatic fuel

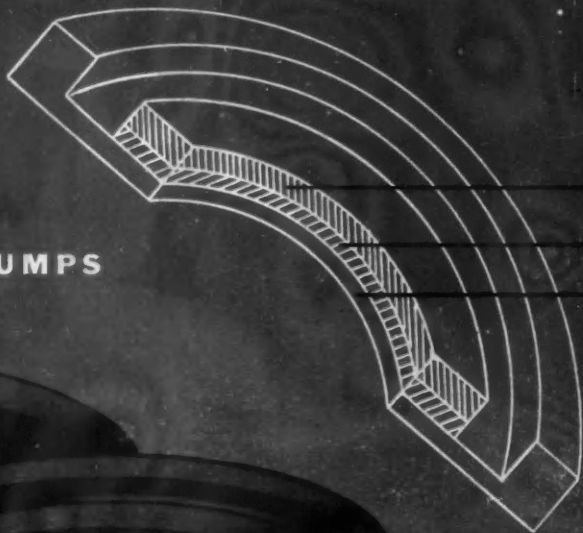
- **Felts** for vibration-damping and soundproofing
- **Wingwalk materials**
- **Resilient floorings**
- **Carburetor floats** and other fabricated natural or composition cork specialties

NEW COHRE SEAL . . .

Bronze Bonded to Graphite

for

- WATER PUMPS
- FUEL PUMPS
- HEAVY LIQUID PUMPS



Resilient synthetic rubber
absorbs shocks and com-
pensates for misalignment
Graphite provides perma-
nent lubrication
Bronze or other metal back-
ing gives solid support



7

In the newly designed Cohre Seal (*Patent pending*) the relatively delicate graphite is shielded by the metallic backing. The two are securely bonded together by a resilient layer of oil-resistant synthetic rubber, especially compounded for this purpose.

If you would like to see how these seals could be designed into your application, please mail prints and data relative to your requirements.

THE CONNECTICUT HARD RUBBER CO.

423 EAST STREET, NEW HAVEN, CONN.

Custom Rubber Molders Since 1920

Simpler, More Compact...
This CONSTANT VELOCITY Universal
 for front-wheel drive & independent wheel suspension

New Process

TRACTA

JOINT



ONLY FOUR PARTS...
 No pivots. Floating central unit. Sliding surfaces of liberal area prevent Brinelling.

As a result of wartime experience, front-wheel drive and independent wheel suspension are due for intensive re-valuation in all types of vehicles. Both require **CONSTANT VELOCITY** universal joints of simple, compact design for efficient application. Preferably universals that operate free from periodic vibrations throughout the entire angular range of known automotive requirements... and joints that provide the large torque capacity demanded by increasingly powerful engines. All of these qualifications are found in the New Process Tracta Joint—based upon 15 years' design and development experience in both Europe and America.

New Process TRACTA Joints
PROVED on Jeeps and Combat Vehicles

Sahara sands, Italian mud, Aloutian sediments, New Guinea jungle—all have tested the toughness and efficiency of the New Process **TRACTA JOINT**. All have proved that this simple, easily-assembled joint functions with absolute smoothness, that it improves traction, saves tires from scuffing, reduces noise and vibration, increases maneuverability, and above all, lengthens joint life.

Write today for sizes, torque capacities, operating and test data.

New Process
GEAR CORPORATION
 High Precision Gears, Transmission, Differentials
 and Axles, Since 1888

SYRACUSE, N. Y.





**Specially Designed for
Economical Production of Cases
from 0.003" to 0.040"**

CARBON NITROGEN CASES obtained with Du Pont Accelerated Salt are similar to those produced in plain cyanide baths. But they are somewhat higher in carbon as operations approach 1650°F. This salt can be used for more shallow cases at 1500° to 1575°F. It is especially useful for hardening light sections that must be oil-quenched to minimize distortion. Bath control is easier. Replenishment is moderate. Here is just one of many Du Pont heat

treating materials designed to meet wartime needs for faster, more economical case hardening work. Skilled metallurgists in our laboratories and in the field will help you select the right salt to meet your special requirements.

Write: E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Dept., Wilmington, Delaware.

**Use it up . . . Wear it out . . .
Make it do . . . or do without!**



**molten
salt baths**

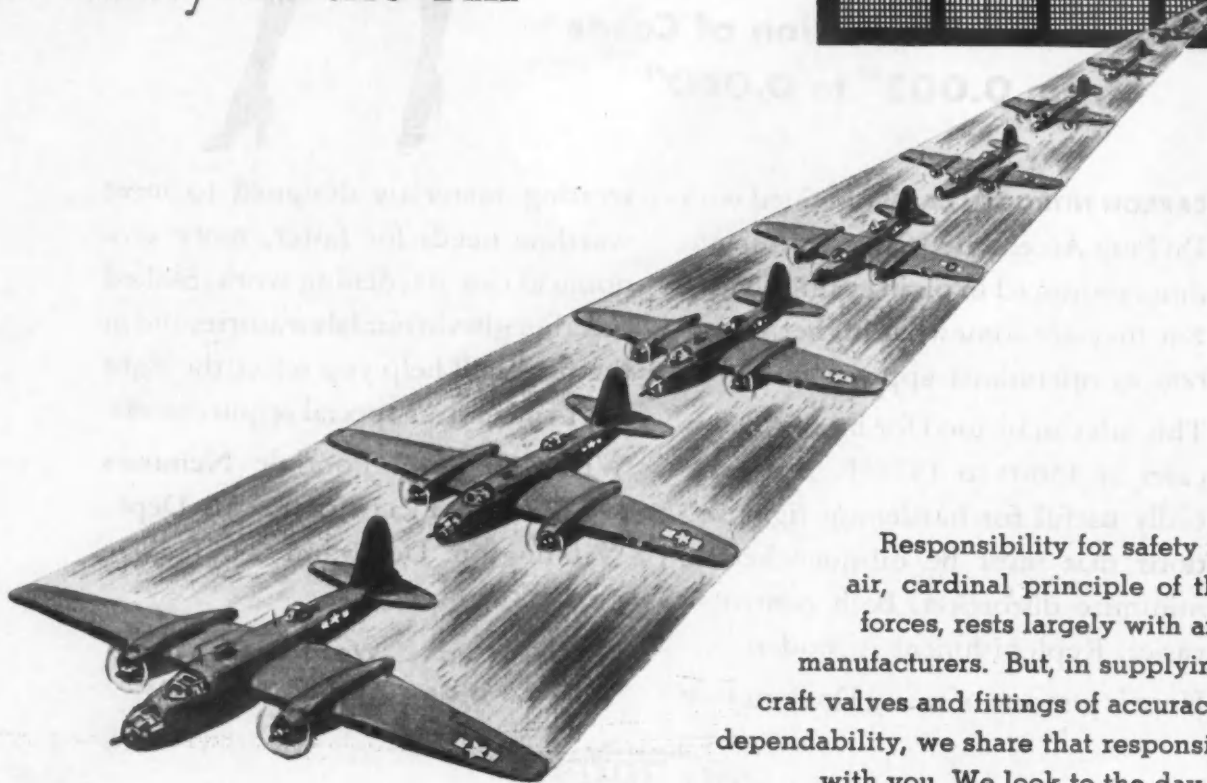
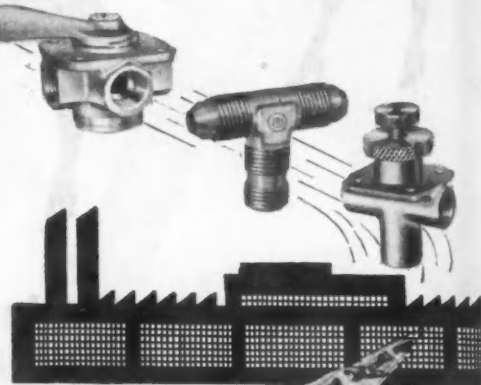
**FREE MANUAL
ON MOLTEN SALT BATHS**
More than 70 pages of
practical material on heat
treatment, fully illustrated.
Ask for your copy.

**DU PONT
CYANIDES and SALTS**
for Steel Treating

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY



Sharing with You
the Grave Responsibility
of Safety in the Air



Responsibility for safety in the air, cardinal principle of the air forces, rests largely with aircraft manufacturers. But, in supplying aircraft valves and fittings of accuracy and dependability, we share that responsibility with you. We look to the day when our partnership can be applied to peacetime production, to help bring new standards of safety to commercial and civilian flying.

DOLE

AIRCRAFT VALVES & FITTINGS—

Made in Accordance with Army and Navy Aeronautical Standards

THE DOLE VALVE COMPANY • Established 1906 • 1901-1941 Carroll Ave., Chicago 12, Ill. • LOS ANGELES • DETROIT • PHILADELPHIA

Preventing

FAILURE IN SERVICE!

NO DEFECT CAN ESCAPE THIS EYE!

Looking into metal with this million volt "eye" safeguards C. W. C. castings against porosity, blow-holes, shrinkage cracks or inclusions.

Because of thorough X-Ray inspection and other scientific control methods the products of C. W. C. are of consistently high quality. Such extraordinary precautions eliminate the possibility of failure in service.



Dials register a million volts as ray penetrates the casting.



Preparing a crankshaft for the X-Ray. Giant "eye" is lowered to the proper level.



Studying structure as revealed by X-Ray.



Type of cast crankshaft furnished for over 9 years for the Fairbanks-Morse famous O-P Diesel Engine.



Centrifugally cast cylinder liners and sleeves provide excellent machinability, high Brinell and extremely satisfactory wear and corrosion resistance.

CAMPBELL, WYANT & CANNON FOUNDRIES

• MUSKEGON, MICHIGAN
Henry Street Plant
Sanford Street Plant
C. W. C. Crankshaft Corp.
• SOUTH HAVEN, MICHIGAN
National Motor Castings Co.



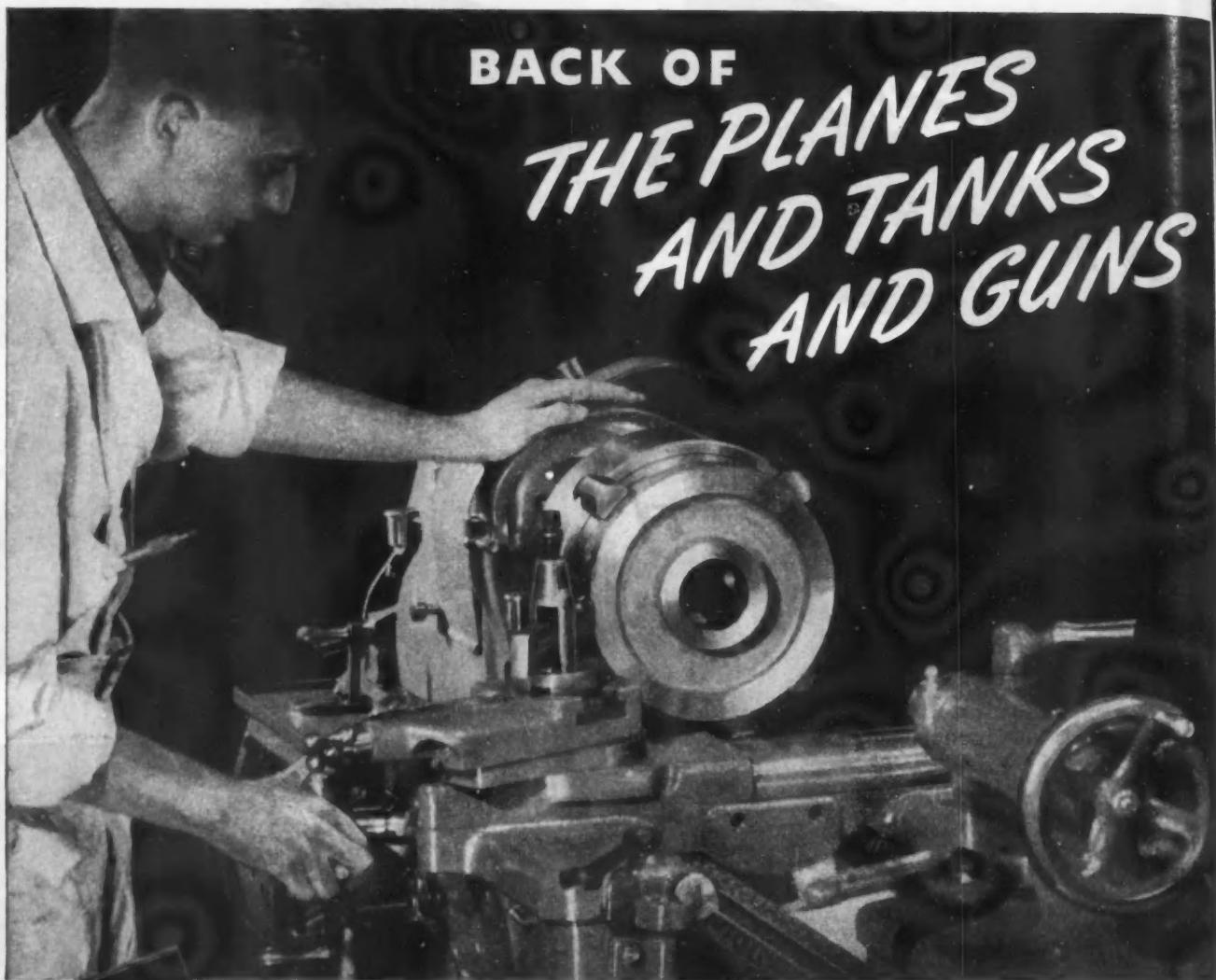
• LANSING, MICHIGAN
Centrifugal Foundry Co.
• BETTENDORF, IOWA
Ordnance Steel Foundry Co.

Casting is our profession!

Through metallurgical research . . . the development of new electric furnace alloyed metals . . . the progressive advancements in casting techniques and scientific quality control, C. W. C. is continually establishing in proven results the outstanding advantages of casting as compared to other methods of manufacture.

Higher quality, lower costs, absolute freedom from limitations upon design—these are the advantages you will get from C. W. C. castings. Consult our engineers now.

CAMPBELL, WYANT & CANNON FOUNDRY CO.
MUSKEGON, MICHIGAN



BACK OF THE PLANES AND TANKS AND GUNS



All of the South Bend Toolroom Lathes, Engine Lathes and Turret Lathes are described in Catalog 100C. Write for a copy of this new, 48-page catalog.

*Buy
War Bonds!*

Army-Navy
Production Award
With Two Stars



Back of the planes and tanks and guns that are flowing in ever-increasing quantities to our fighting forces is a skillfully coordinated plan of men and machines — a combination of skill, ingenuity and mechanical perfection that is going to win.

Accuracy is the key to the success of this great plan. Without the split-thousandth tolerances that assure perfect interchangeability of parts, the production goals could not be attained — and not enough planes and tanks

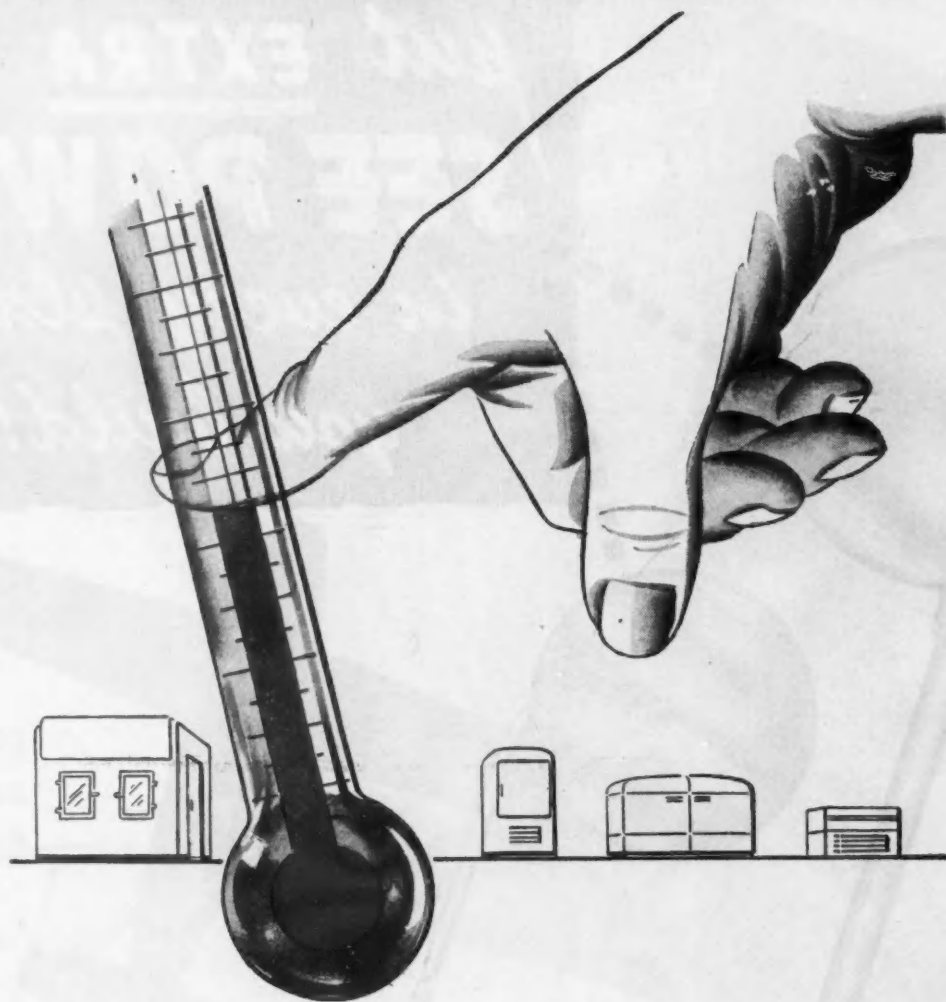
and guns would reach the war fronts.

Capable of fulfilling the demands of urgent war production, South Bend Lathes have the accuracy and speed for the most exacting precision operations, plus ruggedness and power for efficient service.

South Bend Lathes are made with 9", 10", 13", 14½", and 16" swings in both Quick Change Gear and Toolroom models. Practical attachments are available for special classes of work.

SOUTH BEND LATHE WORKS
SOUTH BEND 22, INDIANA LATHE BUILDERS FOR 37 YEARS

INDUSTRY'S NEW SOURCE OF CONTROLLED POWER



Fluid Power DRIVES THE MERCURY DOWN

When the mercury in the thermometer rises too high, many things spoil—including tempers. But Fluid Power forces the temperature down, makes synthetic cold one of man's most useful servants.

Your electrical refrigerator is a good example of this type of Fluid Power. In a closed system of tubing, liquids change into gases and back again to liquids in a repeated cycle. Heat is extracted, carried away, then dissipated into the air.

Applications of this type of Fluid Power are expanding rapidly. Industry uses below-zero cabinets to obtain shrink fits. Home freezers may revolutionize the food storage problem of the future. Air cooling and conditioning may

eventually become a standard in every home.

If you are considering product development using this type of Fluid Power, ask a Parker engineer. He is familiar with the new advances and applications in this field.

Ask a Parker Engineer ABOUT FLUID POWER

Today, you'll find Parker-engineered Fluid Power Systems in locomotives and bombers, in ships, machine tools and chemical plants. If you need FLUID POWER for control or drive, talk the matter over with a Parker engineer. He has the kind of "know-how" you'll find most valuable. Write direct to The Parker Appliance Company, 17325 Euclid Avenue, Cleveland 12, Ohio.

CLEVELAND **THE PARKER** LOS ANGELES
APPLIANCE COMPANY
FLUID POWER ENGINEERING



REAR-VUE MIRRORS

FROM the highways to the skyways is the logical jump for Yankee Mirrors. They've been proved, tested and found "ship-shape" on every American road — for behind them is more than a quarter century of Yankee "know how"!

Such experience enables Yankee to produce Aviation and Rear-Vue Mirrors — superb in quality, ruggedness, and staying power — plus functional design, painstakingly created for America's exacting Aviation Industry.

No wonder the BIG names of Aviation—the United States Army Air Forces—all specify and use Yankee Rear-Vue Mirrors for their greater **SEE POWER**—both on flying fields and in the air—in combat and trainer planes.

Production Men and Plant Superintendents: Information and other pertinent data regarding the use of Yankee Rear-Vue Mirrors is available on request. Yankee designers and engineers are ready to help.

**IN TRUCKS: IT'S YANKEE FOR FOG LAMPS . . . MARKER LIGHTS . . .
SIDE-VUE MIRRORS . . . REFLEX REFLECTORS . . . STOP LIGHTS . . . TAIL
LIGHTS . . . DOME LIGHTS . . . DIRECTIONAL SIGNALS**



Just wire or write

YANKEE METAL PRODUCTS CORP., NORWALK, CONN., U.S.A.

This tells the "whole truth"
about Armature Windings

Nothing
less
than

Perfection goes...
with

EMERSON-ELECTRIC AIRCRAFT MOTORS

The oscillographic equipment shown above is used to test the armature windings of Emerson-Electric aircraft motors. Only when a horizontal line image on the oscillograph screen indicates perfect coils, is the armature passed.

Armatures with any of these electrical defects, shorts, opens, reversed connections, overwound or underwound coils, are unerringly detected.

Continuous, rigorous inspection from raw materials to final assembly is maintaining Emerson-Electric's reputation for quality production—full particulars are given in a new illustrated booklet—"Emerson-Electric Aircraft Motors".


THE EMERSON ELECTRIC MFG. CO., ST. LOUIS 3, MO.

Branches: New York • Chicago • Detroit • Los Angeles • Davenport

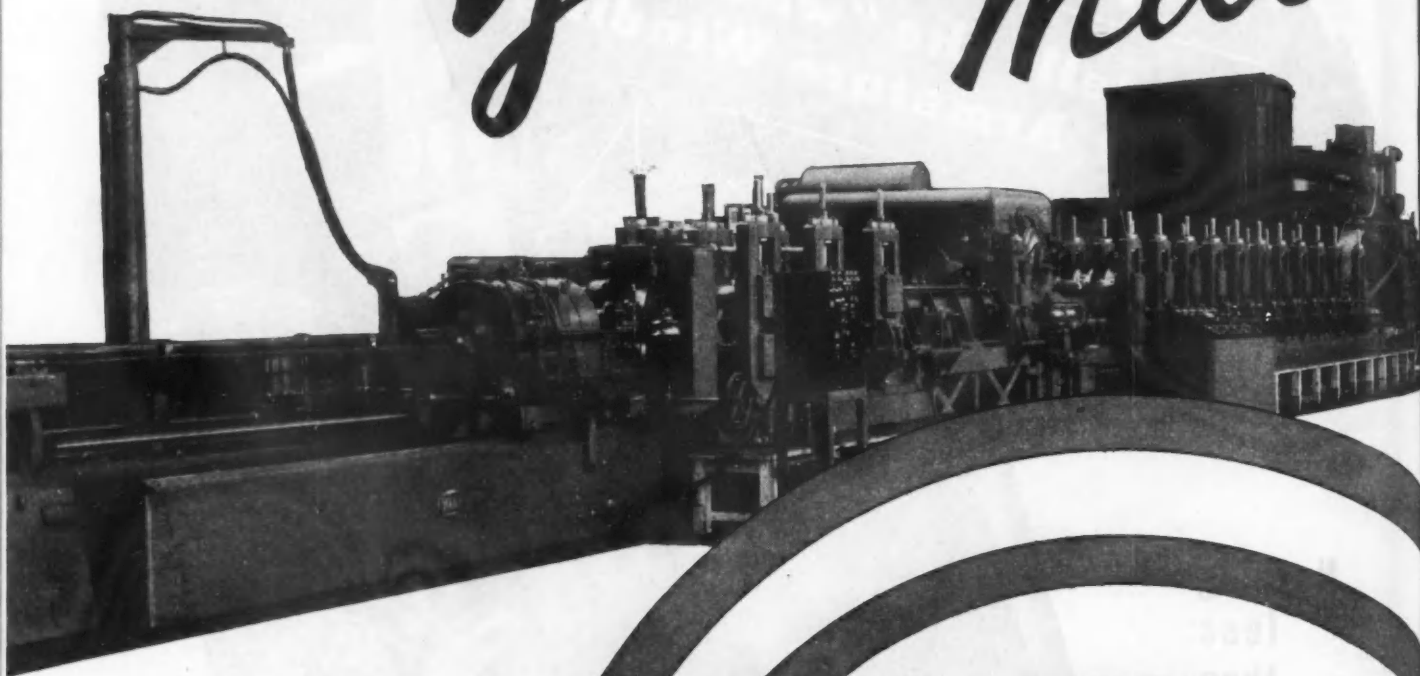


EMERSON-ELECTRIC AIRCRAFT MOTORS are made for gun turret drives, hydraulic units, fuel pumps, actuators, winterizing units, communication systems—also with built-in gear and magnetic brake.

398

EMERSON  ELECTRIC
HOME COOLER FANS KITCHEN VENTILATORS

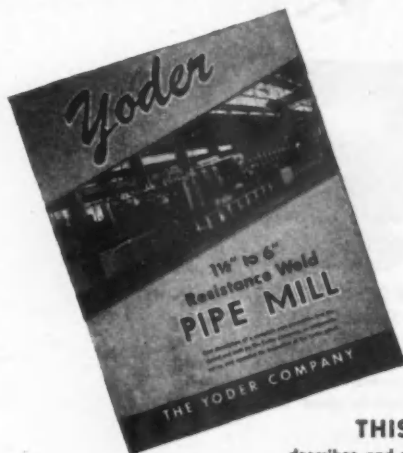
This Yoder Mill



**MAKES RESISTANCE
WELD STEEL PIPE
OR TUBE IN**

THESE SIZES →

from continuous strip stock



THIS BULLETIN

describes and pictures units which make up a 1 1/2 to 6 inch Yoder Pipe Mill. A limited number still available for officials or engineers of associated industries. Please write, giving your name and title.

**ACTUAL
SIZES**

THE YODER COMPANY

Machinery for Metal Manufacture

5500 WALWORTH AVENUE

CLEVELAND 2, OHIO



Three versatile Carburizing Alloys for today's needs

If you're manufacturing parts that demand carburizing grades of alloy steels, you'll be interested in A 4620, NE 8720, and NE 9420.

Because these three oil-quenched steels have much in common, their uses tend to overlap in certain respects. This results in considerable interchangeability—something to remember in these days of wartime shortages. But there's another distinct advantage, too—the simplicity and similarity of the heat-treating requirements of the three steels.

For instance: if necessary to develop maximum case hardness, all three can be carburized at 1700 deg. F. for 8 hours; oil-quenched direct from the pot and tempered at 300 deg. Other effective properties can be attained by pot cooling, reheating, quenching, and tempering, while maximum refinement of case and core is secured by a double quench and temper.

When greater core toughness is desired, the same procedures are followed, but the drawing temperature is increased to 450 deg.

A tremendous amount of research on wartime steels has been done by Bethlehem metallurgists—research that has included the most exhaustive laboratory tests. If you have a problem involving analyses, properties, heat treating, or applications, write Bethlehem Steel Company, Bethlehem, Pa.

PARTIAL LIST OF USES:

A 4620

Bearing balls
Clutch and drive pinions
Gears
Power boat transmissions
Splines
Starter drives

NE 8720

Airplane fuel pumps
Bearing balls
Bearing races
Camshafts
Clutch parts
Gears and pinions

NE 9420

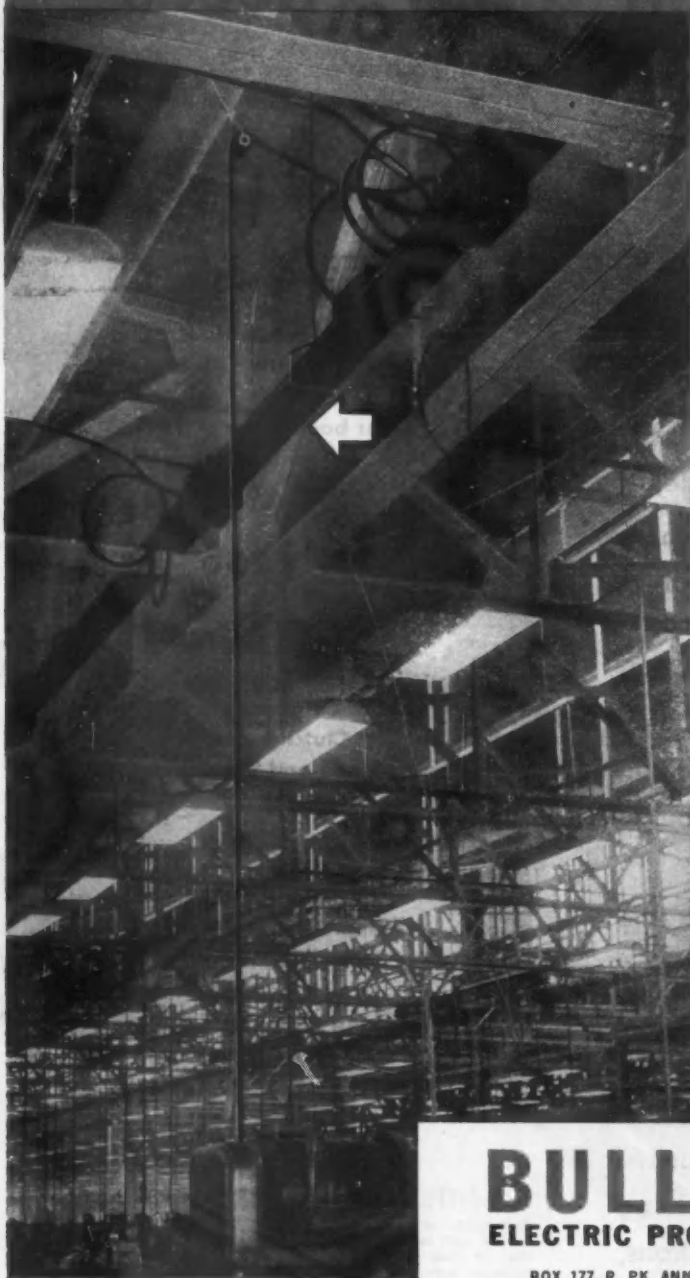
Airplane forgings
Gears and pinions
Piston pins and rings
Roller bearings
Steering arms and joints
Tread chains
Valve tappets
Windlasses



FROM LANDING CRAFT



... BACK TO PEACETIME PRODUCTS



ALSO MANUFACTURERS OF
VACU-BREAK SAFETY SWITCHES • SWITCH-
BOARDS • SAFTOFUSE PANEL BOARDS •
CIRCUIT MASTER BREAKERS • UNIVERSAL
TROL-E-DUCT • INDUSTRIAL TROL-E-DUCT.

BULLDOG WILL SPEED RECONVERSION

In the great war conversion race, BullDog Electrical Distribution Systems have cut weeks — even months — from change-over schedules. Maintenance time and cost were slashed. Output was stepped up, safety improved.

The reason? BullDog Bus Duct systems make plug-in power for machines immediately available for any shop set-up—furnish mobile power for portable tools, cranes and hoists—provide completely flexible lighting.

Looking ahead, BullDog-equipped plants can also count on speedier, easier reconversion to peace production.

Now is the time to plan for the *reconversion* race. We offer the help of expert BullDog engineers, and will gladly send complete literature.

There's a Big Job Ahead — Buy More War Bonds



BULLDOG ELECTRIC PRODUCTS CO.

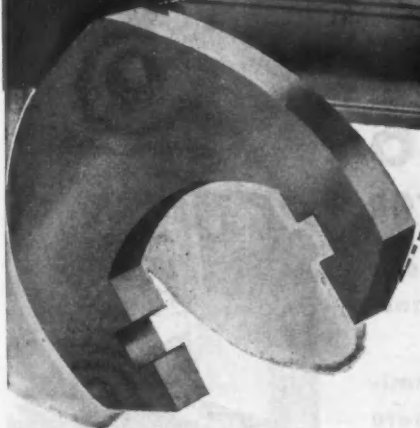
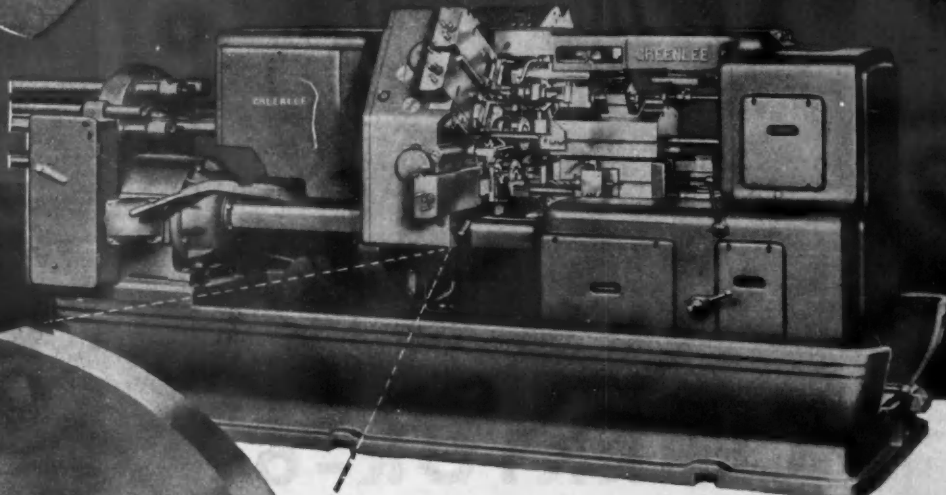
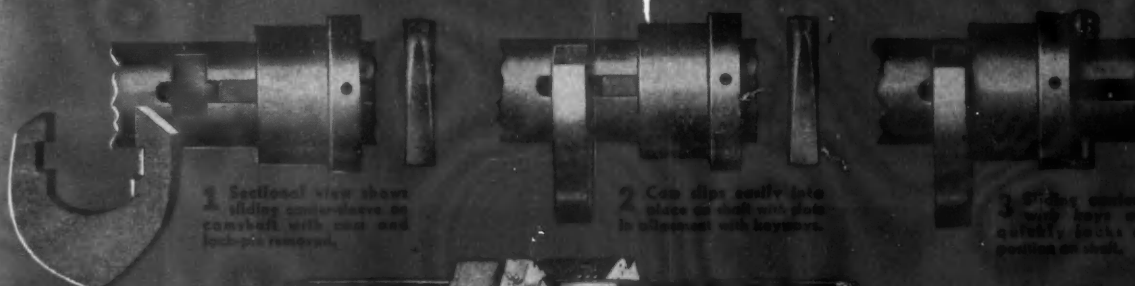
BOX 177, R. PK. ANNEX
DETROIT 32, MICHIGAN
BullDog Electric Products of
Canada, Ltd., Toronto, Ont.



Field Engineering Offices in All Principal Cities

BullDog BUStrribution DUCT provides complete flexibility on branch power circuits. The plug-in feature enables you to change production machines at will — rearrange whole departments without interrupting production elsewhere.

GREENLEE QUICK-CHANGE CAM PRINCIPLE SAVES TIME FOR SET-UP MEN



GREENLEE 6-SPINDLE AUTOMATICS

STANDARD INTERCHANGEABLE CROSS-SLIDE CAMS CUT TOOLING EXPENSE

Simplicity of design makes it possible, today, to operate Greenlee Automatics effectively on more than just the ordinary "cut-and-dried" multiple-spindle screw machine jobs. The cross-slide cam feature on the Greenlee, *for example*, promotes production efficiency on many short-run jobs by reducing set-up time and through savings in tooling expense.

As shown in top photos, individual cams (only one used for each independently operated cross-slide) are quick and easy to slip on or off. All cams are completely interchangeable and may be used on any cross-slide. Thus, only a very few are required — see details at left.

There are other *time-saving, cost-saving* Greenlee features, too, that offer production advantages in building weapons of war or products of peace. Ask for latest details. Perhaps Greenlee engineers can help you tie in war demands, today, with your peace conversion plans. *Write —*

GREENLEE BROS. & CO., 1767 MASON AVE., ROCKFORD, ILL.

SMALL CAM INVESTMENT HANDLES 90% OF AVERAGE JOB-SHOP REQUIREMENTS

With a Greenlee 6, a job-shop can handle 90% of average requirements with but fifteen standard cross-slide cams which provide a wide variety of feeds and strokes. *Seldom are special cams required.* An exclusive Greenlee feature eliminates the use of cams on main tool slide.

The following list of cams are all that are usually needed for one machine to serve a wide range of requirements:

| Quantity | * Cam Ratios |
|----------|--------------|
| 2 | 2:1 |
| 3 | 3:1 |
| 3 | 4:1 |
| 2 | 5:1 |
| 2 | 6:1 |
| 1 | 8:1 |
| 1 | Cut-Off |

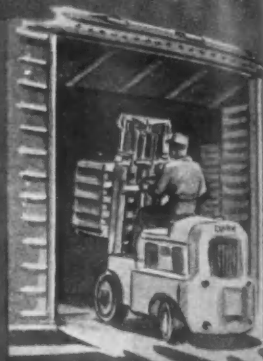
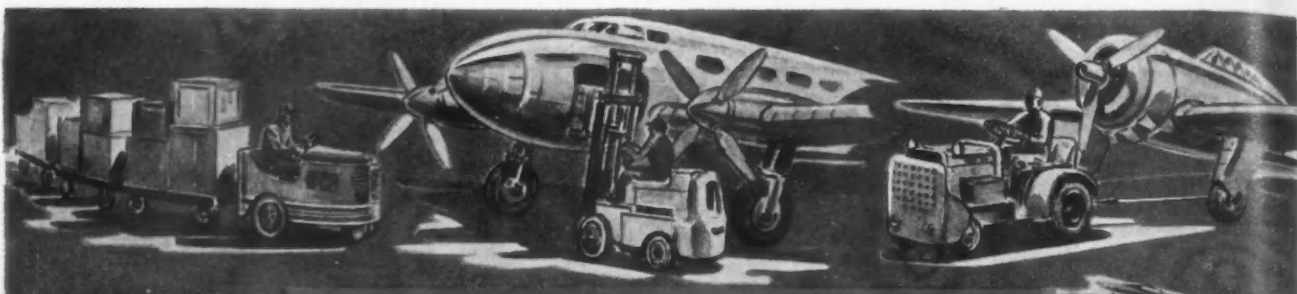
TOTAL INVESTMENT... ONLY \$131.35

* Standard cams are made in ratios to tool-slide feed and stroke. For example, 2:1 Cam = $\frac{1}{2}$ feed of tool-slide and $\frac{1}{2}$ stroke. Feed = feed per revolution.



GREENLEE

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES



CLARKTOR-6 INDUSTRIAL TOWING TRACTOR

The BIG job today and always is faster movement of materials. Delays in transportation cannot be tolerated.

Factories, warehouses, railway terminals and air ports are the hot spots where materials hit the bottleneck.

"Clarktor-6" towing tractors quickly relieve congestion in these areas. They tow loads up to 85 tons and prove their staying qualities on the job 24 hours every day.

They're built like a battleship and powered by gas for continuous service.



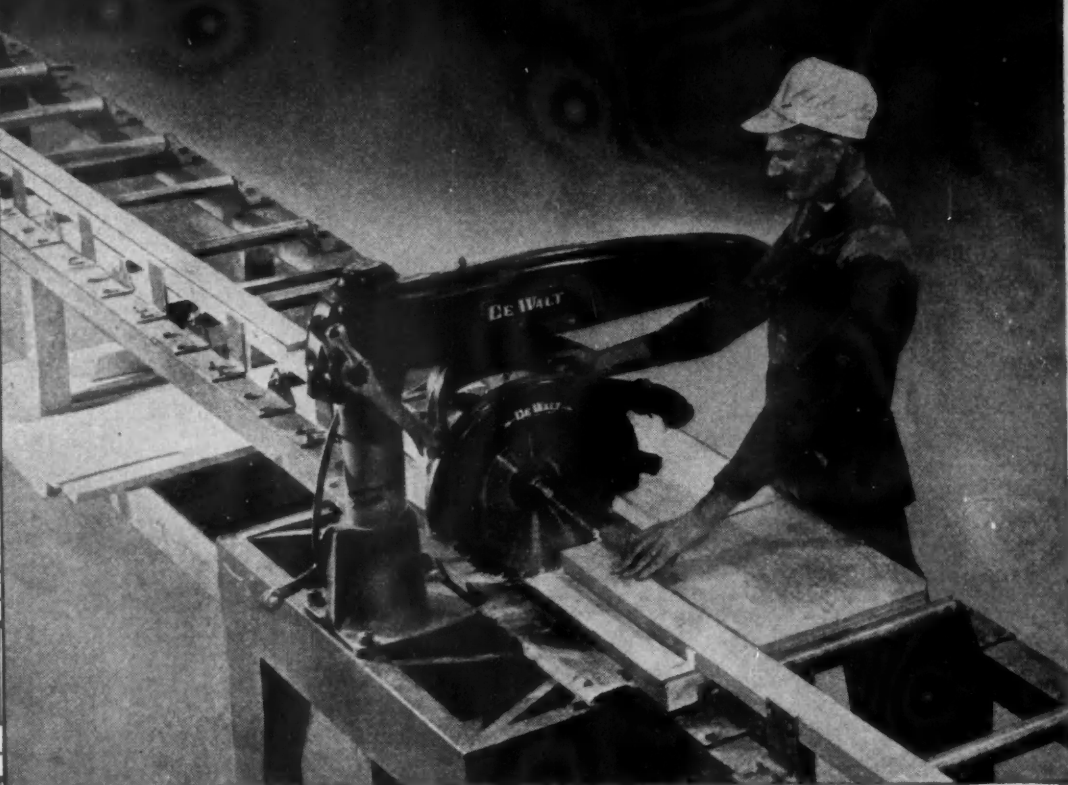
Clark Tractor builds industrial haulage vehicles for every material handling operation.

Write for New Vest Pocket Catalog

CLARK TRUCTRATOR
DIVISION OF CLARK EQUIPMENT COMPANY
BATTLE CREEK, MICHIGAN, U.S.A.

OTHER CLARK PRODUCTS—AXLES (Front and Rear) FOR TRUCKS AND BUSES • AXLE HOUSINGS • TRANSMISSIONS • METAL SPOKE WHEELS • ELECTRIC STEEL CASTINGS • GEARS AND FORGINGS • RAILWAY TRUCKS • BLIND RIVETS • HIGH-SPEED DRILLS AND REAMERS

DE WALT ANSWERS INDUSTRY'S NEED FOR A VERSATILE ALL-PURPOSE CUT-OFF SAW!



Here's a DeWalt that you can use for many jobs anywhere in your plant now!

DeWalt is the ALL-PURPOSE machine that can be changed quickly, as required, from a straight-line cut-off saw—to miter saw—to rip saw—to dado machine—to shaper—or other operations that can be

made with circular cutting tools.

Investigate DeWalt. Install a DeWalt. Reduce cutting costs. Simplify materials handling. Eliminate waste. Save time. DeWalt is available in models ranging from ½ H.P. to 10 H.P. Send coupon below for full information.

DE WALT
*Makes Every Cut Possible
With a Circular Saw*

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5805 Fountain Avenue, Lancaster, Penna.
Please send me information on your complete line.

Name.....
Address.....
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Lambert Disc Brake

Disc Clutch


Lambert Disc Brake

Air • Hydraulic • Mechanical

Auto Specialties Manufacturing Co.
St. Joseph, Michigan
Canadian Plant... Windsor, Ontario

The Lambert Disc Brake Hydraulic Operated

This Lambert Brake was especially designed for heavy duty tractor service. Its performance has been proven on a substantial number of tractors, utilizing heavy friction materials, controlled only for the 100% service on the tractor drive shaft. It has shown extra durability and the very highest friction, with equally high efficiency, both in forward and reverse motion, a distinct contribution to the ease and safety of tractor operation.



The Lambert Disc Brake Data Book is Now Ready for the Engineers

Now available is this thirty-six page booklet, bringing to engineers and planning committees detailed data on the revolutionary new Lambert disc brake that harnesses momentum, eliminates brake drums, reduces weight and provides greater braking area. Sent without cost or obligation to the men charged with responsibility for the production of tomorrow's finer cars, trucks, buses, tractors and aircraft. In it will be found the specifications, explosion photos and other data necessary to provide a complete visualization of the brake advancements embodied in this revolutionary new brake for post-war America. Write for your complimentary copy today. AUTO SPECIALTIES MFG. CO., ST. JOSEPH, MICHIGAN.

Lambert

Air • Hydraulic • Mechanical DISC BRAKES





TWO THINGS INDUSTRY MUST DO NOW TO MAKE HIS AMBITIONS COME TRUE



Burgess Norton

MANUFACTURING COMPANY

40 years in GENEVA, ILLINOIS

The American soldiers' ambitions must come true. In making them come true, American Industry has a tremendously important part and responsibility.

Enormous purchasing power must be maintained to make these dreams come true. We recognize in War Bonds not only their essentiality in providing the materials of war but their essentiality in contributing to the winning of the kind of a peace-time America of which every soldier dreams.

The first thing we must do is to continue with our every resource that which American Industry has been doing with such outstanding success... the unceasing, never-ending, all-out support of War Bond Sales.

Second, we must WORK our hardest at the job of putting our houses-in-order so that we can produce MORE GOODS... BETTER GOODS... GREATER VALUE IN GOODS and SECURE GREATER EFFICIENCY IN GETTING THEM INTO THE HANDS OF THE ULTIMATE CONSUMER.

The miracle of American War Production is an actuality. The miracle of post-war American Production is the challenge. We are confident that American Industry will be ready to meet it.



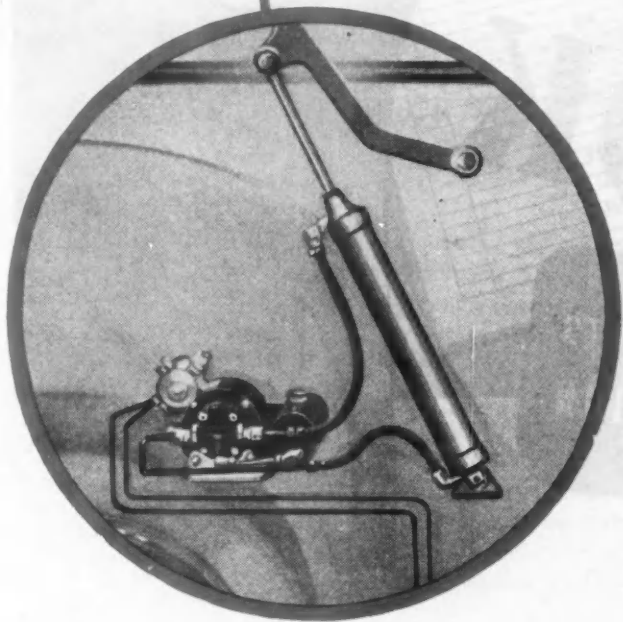
This message is published in the interest of War Bond Sales and a prosperous post-war America of Free Enterprise by Burgess-Norton Mfg. Co., the services of whose Engineering Staff, Metallurgical and Research Laboratories are available now to the manufacturers who will require piston pins, screw machine parts, heat treated and ground steel products, hydrogen, copper brazing, non-precision ball bearings and related fabricated steel products.

A Part is Never Made Right unless it is Satisfactory to Our Customers

Do you have a **SERVO POWER PROBLEM** ?



One of the popular uses of the Motor State Products Company Hydraulic unit is the raising and lowering of convertible tops. Equalized power in each of the two cylinders raises the top smoothly.



Equalized power is exerted to each side through interconnected hydraulic cylinders, making it impossible to bind, twist, or bend the top. Synchronized lifting effort is assured at all times.

The by-pass valve located in the hydraulic channels within the pump may be adjusted to operate at a definite pre-determined pressure. This safety feature allows the top to be stopped by hand at any point in the travel without building up and increasing pressure. Damage by overrun either in extending or lowering the top is impossible.

When the power is off, the interconnecting valve connects both ends of the cylinders. This feature makes it possible to operate the top manually, without damage to mechanical parts.

MOTOR STATE HYDRAULIC POWER UNITS ARE ENGINEERED FOR INSTALLATIONS WHERE:

1. Finger-Tip Remote Control of smooth, positive action at constant pre-set speeds and pressures and definite limits of power are required.
2. Ease of Installation and adaptability to body or product design is an important factor.
3. A sealed, trouble-free unit delivering a synchronized actuating force to one or more working points is essential.

It's Time Now to Think of Postwar Schedules

Like everyone else, the Motor State Products Co. is pretty busy these days. The time is coming, however, when we all shall turn back to peacetime manufacturing. And when we do there's likely to be considerable hurry to get plans and schedules organized—

The time to do this planning is right now, whenever there are a few minutes that won't rob the war effort. Our engineers—specialists in the design and application of Hydraulic Power Units—work on that principle, and we are glad to offer, on this limited basis, a consulting service on postwar Hydraulic Power Applications.

Contact Motor State Products Company at 2-257 General Motors Building, Detroit 2, Michigan.

MOTOR STATE PRODUCTS COMPANY

YPSILANTI, MICHIGAN

ORIGINATORS AND MANUFACTURERS OF THE PUSH-BUTTON CONVERTIBLE TOP

September 1, 1944

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EVERY *Logan* LATHE GETS
THIS FINAL INSPECTION



The outstanding performance of Logan Lathes in sustained accuracy and speed results from the exacting care that goes into every detail of construction. In the final inspection, a point-by-point check of the entire machine assures a completed assembly ready for production service. Of equal importance, all individual parts and all sub-assemblies are thoroughly tested as they are manufactured to prevent incorporation in the machine of any part not

up to standard. The rigorous checking of parts, sub-assemblies, and the final inspection, strictly control the consistent accuracy and quality characteristics of Logan Lathes. Ask your nearby Logan Lathe dealer, or write for latest catalog describing all models of Logan Lathes.



LOGAN ENGINEERING CO.

CHICAGO 30, ILLINOIS

A NAME TO REMEMBER WHEN YOU THINK OF LATHES



Out of the Nation's War Plants Comes

OAKITE CRYSCOAT PROCESS

**A low-cost chemical conditioning treatment for steel and
iron surfaces and fabricated work that inhibits rust
and solves the problem of paint adhesion**

This new, scientifically engineered Oakite development, now successfully used on many different types of war matériel, can be employed on a wide variety of peacetime products to which paint and similar organic finishes are applied and where surface protection is a prime factor.

Performs THREE Functions In ONE Operation!

Performing THREE distinct functions in ONE time-saving operation, Oakite CrysCoat No. 86, an integral part of the Oakite CrysCoat Process, marks an important advance in the surface preparation and conditioning of ferrous metals before painting. Used in automatic pressure spray machines or by tank immersion method, Oakite CrysCoat No. 86:

- ① Removes light oils, grease, drawing lubricants, shop dirt
- ② Imparts a microscopic protective crystalline coating that inhibits surfaces against rust
- ③ Provides surface grippage that assures firm, **TENACIOUS ADHESION** of paint or other organic finish

Free Special Service Report Gives You Details!

A **FREE 3-page Service Report** gives you operating details, describes methods of application and the many advantages resulting from the use of Oakite CrysCoat No. 86. Write for your copy today.

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FOR EVERY CLEANING REQUIREMENT



ARMED TO THE TEETH AND PROTECTED BY UDYLITE

Like the "almost" invincible Achilles, America's fighting machines must have dependable, complete protection from attack. Attack not only from bombs and bullets but also from the relentless elements to which they are constantly subjected. ★ The name UDYLITE has never blazed as hero of this fight nor figured in the headlines of the day—yet it is difficult to name a single piece of metal war equipment or a single fighting machine which does not carry "protection by Udylite". Protection afforded by reliable Udylite equipment and our many perfected processes. In jobs that must not fail they choose UDYLITE.

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And now we add *Embossing* to make CLOTH serve more people . . . more ways . . .

Embossing is a surface treatment generally applied to coated cloth to secure a decorative effect or to simulate a naturally irregular surface. One of the most common forms of embossed treatment copies various leather finishes and many so-called "imitation leathers" have all of the appearance value and

much of the durability of leather and, in addition, are waterproof, non-porous and uniform. Various coarse fabric textures are embossed as well as all-over designs. A combination of embossing with printing (color on high spots) produces unlimited pleasing contrasts.



EMBOSSING

Under pressure a relief pattern is produced in the plastic coating. The cloth structure is in no way damaged or weakened. For certain industrial uses embossing may create lines or marks of functional value.

CURRENT HOLLISTON PRODUCTION includes COATED AND IMPREGNATED FABRICS. INSULATING CLOTH BASE. SEPARATOR CLOTHS rubber, starch-filled, glazed. TRACING AND BLUE PRINT CLOTHS white and blue, ink or pencil. MAP CLOTH, PHOTO CLOTH, self-adhesive. REINFORCING FABRICS. SIGN, LABEL AND TAG CLOTHS, waterproof to take any ink, meet any inking problem. BOOK-BINDING CLOTHS. SHADE CLOTH, impregnated waterproof, opaque, translucent or light proof.

We urge you to consider CLOTH; and invite you to consult with us concerning possibilities and developments for your specific requirements.

The Holliston Mills, Inc.
PROCESSORS OF CLOTHS FOR SPECIAL PURPOSES
NORWOOD, MASSACHUSETTS
Sales Agents in Principal Cities

Stamping this carbine trigger housing from **COLD ROLLED** **STRIP**



★ Saved 720,000 hours machine time

★ Saved 635 tons of steel

★ Saved \$5,100,000 in cost (on the basis of producing two million pieces)

THE conversion of this one part of the U.S. M-1 Cal. 30 Carbine, from a steel forging to copper-brazed strip steel stampings saved *more* than these substantial amounts of time, materials and money. It also released 97 milling machines, 16 broaching machines and 21 profilers for the production of other badly needed ordnance parts.

The production in strip steel of this trigger housing is typical of the important work of redesign and conversion being done by Ordnance engineers and leaders of the pressed metal industry. Some 800 conversion suggestions like this already put into

actual production have resulted in savings of enormous amounts of critical materials, have released countless numbers of critical machines, have saved millions of man-hours, saved millions of dollars as well.

The ready adaptability of cold rolled strip steel to this far from simple part—in which final tolerances were maintained to within .002" and .005"—and the savings in weight and cost it makes possible are, we believe, significant to every manufacturer who is looking ahead for ways to improve his peacetime product and to reduce its cost.

We have in our files the records of

many such war-time applications of American Quality Cold Rolled Strip that not only indicate the wide field for postwar applications this versatile metal offers but that show, by actual time and cost saved in fabrication, the economic advantages of its use.

Our engineers will gladly discuss this matter in detail with you at your convenience.

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, Pacific Coast Distributors
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UNITED STATES STEEL



Are Your PRECISION GAGE BLOCKS Still Safe to Use?

All Precision Gage Blocks have one thing in common . . . they eventually wear. New blocks are made accurately within a few millionths of an inch. That is why you bought them . . . for use as dependable master standards.

But only a little wear on a few of the most often used blocks can change a whole set into a potential source of dangerous errors when you use these worn blocks to set the working gages that in turn govern your whole production accuracy. That is why we recommend periodic expert inspection of your Precision Gage Blocks . . . a sure way to safeguard the source of Accuracy for your whole inspection system.

*Regardless of Where You Bought
Them . . . The Answer is . . .*

**PRATT & WHITNEY INSPECTION
of your PRECISION GAGE BLOCKS**

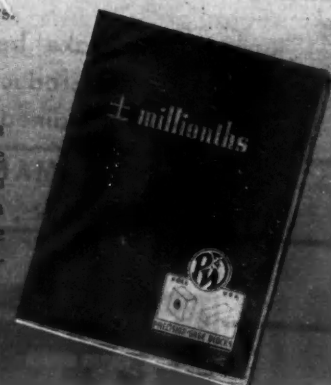
Here is how it works . . .

1. Send your blocks to our factory at West Hartford, Conn., with an order to inspect them.
2. Each block is individually cleaned, and all burrs, bruises or scratches are carefully stoned.
3. Each block is inspected for flatness, parallelism and length in our constant temperature room by our gage experts, using our extremely sensitive measuring equipment.
4. Our exact readings on each block are listed in an Inspection Certificate, plus our inspector's recommendation of replacement when he finds any block so worn or damaged as to be unsafe for use.
5. This Certificate is returned to you.
6. You then instruct us to either replace dangerous blocks with new ones from our stock, or to return your set "as is."
7. If you instruct us to replace worn blocks we will do so at individual block prices, and return your set in first class condition.



In this vibration-free, constant temperature room Pratt & Whitney Grand Masters are checked and calibrated by an interferometer. Periodically these Masters are sent to the National Bureau of Standards for additional checking. Every gage block sent to P&W for inspection is individually checked against these Masters.

*For full information on
new sets of P&W Hoke
and USA Precision
Gage Blocks, write on
your letterhead for the
Pratt & Whitney book-
let "± Millionths."*



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WEST HARTFORD 1, CONNECTICUT

38

YEARS OF SERVICE



TOMORROW

We will make better locks, better hinges, better assembled products of all kinds because of our experience gained in Wartime industry.

HANCOCK MANUFACTURING COMPANY
JACKSON, MICHIGAN, U. S. A.



Design that part in

ArmaSteel*

**THIS GUN REPORT
Should Put You
"On the Trigger"**

.50-CALIBER MACHINE GUN BARREL SUPPORT



With former material, 15½ lb. of metal had to be removed by machining; with ArmaSteel castings, 1-1/10 lb. In addition, the bronze bushing formerly required was eliminated by ArmaSteel's good bearing qualities.

.30-CALIBER AUTOMATIC RIFLE RECEIVER



Weight of stock formerly used to produce this part—25 lb.; weight of ArmaSteel casting to produce part—9 lb. Machining time by former methods—16 to 18 hours; machining time with ArmaSteel—2 hours.

20-MM. AIRCRAFT CANNON MAGAZINE SLIDE



More than 5 lb. of metal had to be machined off forging formerly used; with ArmaSteel, 1-4/5 lb. was removed by machining. Improved machinability of ArmaSteel effected further savings.

ARMASTEEL PROPERTIES

Adaptability to selective hardening (50 Rockwell C and up). Excellent bearing properties. Good fatigue life. High damping capacity. Takes a mirror finish when polished.

There's a Message for Tomorrow in This Metal's Wartime Accomplishments

For the time being, let's forget that ArmaSteel had made a name for itself before the war . . . in scores of vital parts for the automotive, Diesel and appliance industries. Instead, let's look at ArmaSteel the way certain manufacturers did when they were "up against it" on big-volume gun contracts.

ArmaSteel had never been used for gun parts before, but what of it? Here was a versatile metal with a wide range of physical characteristics, available in any yield strength up to 90,000 pounds per square inch, and offering properties and qualities that promised results. Most important of all, it provided 10 to 30 per cent better machinability—cut the amount of metal to be removed to a fraction of former requirements—increased the number of finished parts per tool grind as much as 50 per cent.

So ArmaSteel "stepped into the breach"—and into more than 60 parts for .30- and .50-caliber machine guns, aircraft cannon, automatic rifles and carbines. It boosted production and cut costs on this assignment . . . it can do the same in your products.

CAST FOR A LEADING ROLE IN INDUSTRY



**WAR BONDS
SAVE AMERICAN LIVES**

SAGINAW MALLEABLE IRON DIVISION OF GENERAL MOTORS
SAGINAW, MICHIGAN

*Reg. U. S. Pat. Off.

ONE COST FACTOR YOU CAN REDUCE

In a field of selling prices, standardized by competition, orders go to the manufacturer who can produce acceptable quality at lower cost.

Material costs and labor costs tend to be equal for all manufacturers. The ONE controllable factor, in the individual plant, is TIME.

This is where Acme-Gridley Automatics—4, 6 and 8 spindle—both Bar and Chucking—make their great contributions. They produce more, in less time, with constantly increasing standards of quality and precision.

The future is bright for the manufacturer whose costs tend downward, with the help of Acme-Gridleys. Without them, higher costs are bound to absorb an increasingly large percentage of profits.

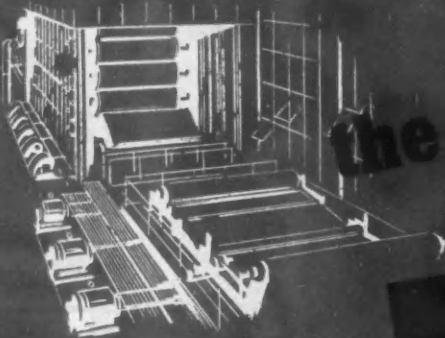
These lower machine costs strengthen your position in two ways—in meeting competition and in protecting your profits.



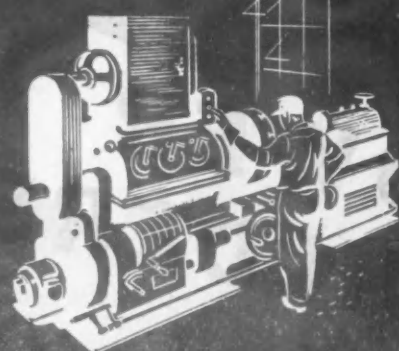
ACME-GRIDLEY AUTOMATICS
maintain accuracy at the
highest spindle speeds
and fastest feeds modern
cutting tools can withstand.

The NATIONAL ACME *Company*
CLEVELAND • OHIO

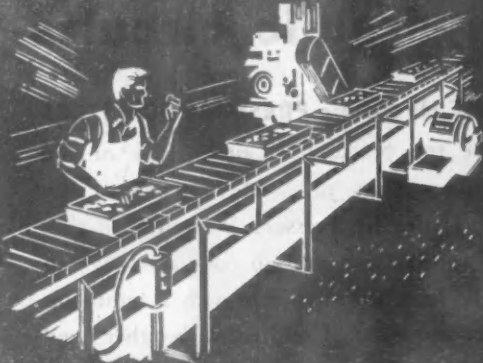
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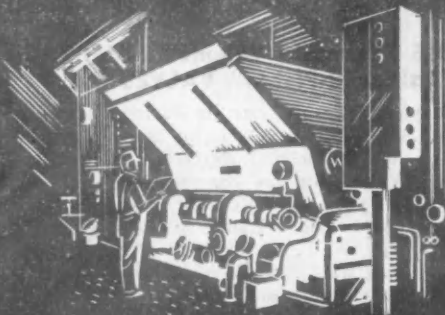
MACHINE TOOLS



MATERIAL HANDLING

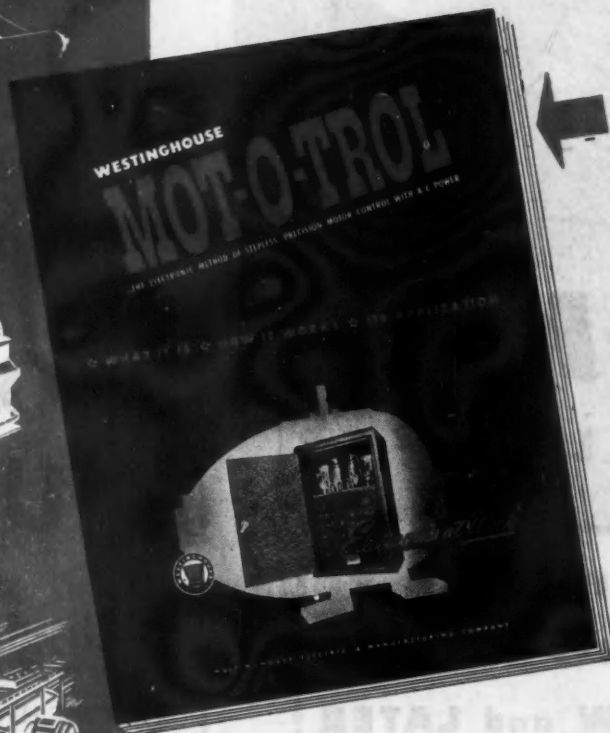


POWER GENERATION,
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Westinghouse
PLANTS IN 25 CITIES OFFICES EVERYWHERE

the answer is in this book



ELECTRONIC

**MOTOR
CONTROL**

How to get Stepless d-c Motor Speeds from an a-c Current Supply

Mot-o-Trol, developed by Westinghouse, employs the precision of electronics to provide a new, wide, *stepless* range of speed control for d-c motors from an a-c current source. It starts motors, brings them up to preset speed smoothly and rapidly. It permits wide change of speed at any time, regulates speed under varying loads, applies dynamic braking for timed stopping—and reverses the motor. Many other functions are also possible. There are no separate linestarters—no field rheostats. To get all the facts about this new packaged motor drive, write today for your copy of booklet B-3301. Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

J-21306

MOT-O-TROL



Electronics at Work

POWDER METALLURGY



WILL FIT INTO YOUR PRECISION-PRODUCTION PLANS NOW and LATER!

The scramble to get *post-war products* on the market will call for speed, just as war-time production does.

Precision and quality will be equally important, too. For the market will be highly competitive.

Many aviation and automotive manufacturers have been using small ferrous and non-ferrous parts by Pomet to meet war-time schedules without losing precision or other rigid requirements specified in government contracts.

In the Pomet plant you can get desired results plus the great production economies that result from fewer operations. For Pomet parts are made in three quick steps. They are compacted, sintered and coined to close dimensional tolerances.

Properties are closely controlled in Pomet parts. Hardness, density, ductility, wearability and other specified qualities can be incorporated to order.

As one of the first plants to start volume production in powder metallurgy we are in a position to give you satisfactory results. Great savings can be made in quantities of 100,000 or more. We will be pleased to quote on blueprints or specifications or to send literature on request.

Don't decide until you see what Pomet can do.

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FROM POWDER

POMET

TO PARTS



POWER BUILDERS

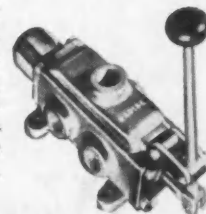
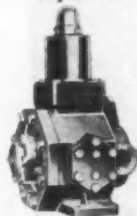
for your
hydraulic circuits

RACINE Hydraulic PRESSURE BOOSTERS

Increase the pressure in either new or old hydraulic circuits to 3000 lbs. per sq. in. Racine Hydraulic Pressure Boosters are simple in construction and so compact they can easily be installed anywhere with a minimum of space and labor. Use them with either fixed or variable volume pumps. They reduce operating and equipment costs. Ask for the latest bulletin and consult any Racine distributor.

RACINE "Variable Volume" PUMPS "Balanced-Piston" VALVES

Include in your hydraulic circuits Racine Pumps. Capacities 12-20-30 g.p.m. Operating pressures 50 to 1000 lbs. p.s.i. Racine Valves for the control of your oil hydraulic circuits are available in $\frac{3}{8}$ " to $1\frac{1}{2}$ " standard pipe sizes. Ask for complete Pump and Valve Catalog No. P-10-C. Address Dept. AA-P.



RACINE TOOL and MACHINE COMPANY

Standard for Quality and Precision
RACINE, WISCONSIN, U. S. A.

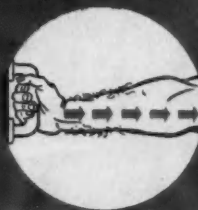
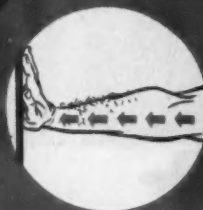


**FOR 100 LBS.
POWER MOVEMENT**

"Tailored to the job"

**FOR EFFICIENT POWER
MOVEMENT IN ANY DIRECTION**

**...OR 50,000 LBS.
POWER MOVEMENT**



Big or little jobs for "mechanical muscle"...are handled with TOP speed and efficiency by T-J Air and Hydraulic Cylinders!

They're ruggedly built to "take it"...with bodies honed to accurate concentricity and straightness...all mounting surfaces strictly inspected for squareness and smoothness...one piece piston construction for greater dependability.

T-J AIR CYLINDERS exert power movement from 100 lbs. to 12,000 lbs. (direct). T-J HYDRAULIC CYLINDERS exert power movement from 1000 lbs. to 50,000 lbs. (direct). Available in sizes, styles and strokes to meet your requirements. Precision-manufactured and expertly engineered with T-J's quarter century experience. Write for latest catalogs. The Tomkins-Johnson Co., Jackson, Mich.

FOR TOUGH JOBS SPECIFY



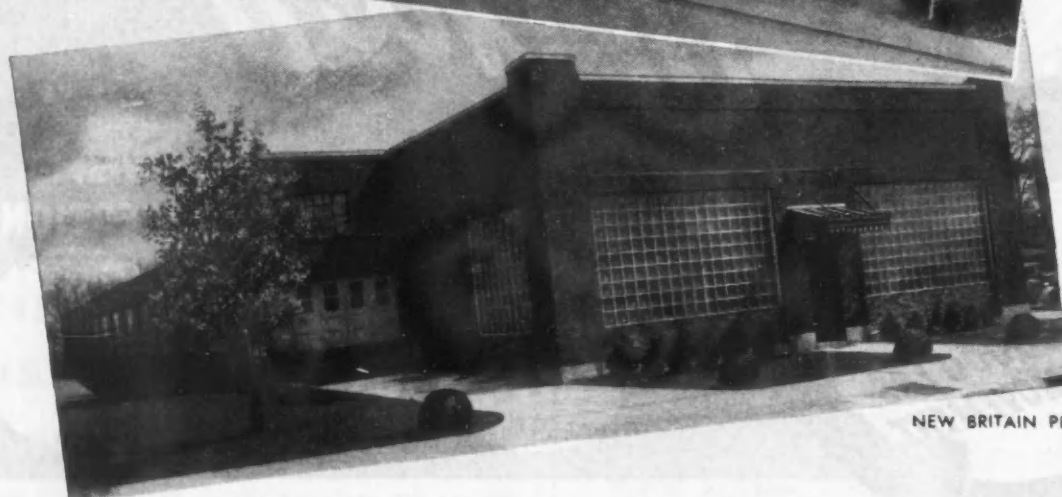
TOMKINS-JOHNSON

RIVETORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

Three Generations of Machine Builders



HARTFORD
PLANT



NEW BRITAIN PLANT

Building War Products Today Peace Time Products Tomorrow

Fenn Plants, wholly engaged in war production today, will, when peace comes, continue building special machinery, in which they have majored for three generations. If you are thinking of building new machines or remodeling old ones, it's time to plan Now.

Fenn Aircraft BUILT PARTS FOR FAMOUS PLANES

Fenn Plants are delivering precision parts and sub-assemblies for planes, artillery and other

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Fenn designers and engineers have solved many knotty problems in machine design, resulting in efficient, profitable production. Fenn has the men

and experience to handle almost any machine design job. Consultation is invited and involves no obligation.

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PRESSURE SENSITIVE ADHESIVE

Experience Alone Isn't Enough

We've been making many kinds of adhesive tapes for nearly 50 years . . . we *have* experience—lots of it . . .

. . . but we don't rely on that *alone* in recommending industrial adhesive tapes for your needs.

We analyze *your own* specific problems . . . through plant surveys . . . through careful tests in our own laboratories.

And *then* we draw on our experience to *help* us determine the right tapes for the jobs you want done.

That system . . . uncovering the problems . . . testing and re-testing . . . applying the accumulated experience of almost half a century . . . has helped users of Bauer & Black Industrial Adhesive Tapes to cut tape costs 15% to 45%. Production time and costs have been reduced and general plant operations have been made more efficient.

We think it's a system you'd like to try.

CASE HISTORY NO. 10

Bauer & Black Plant Survey Helps Speed Shell Packing

One of America's largest shell loaders installed machines which automatically wrapped Bauer & Black Adhesive Tape around shell containers. Standard 60-yard rolls were being used, but that meant shutting down the machines every six minutes to "reload." Bauer & Black engineers recommended and perfected the use of 250-yard rolls to reduce shutdown time.

No standard shipping container would carry the large rolls and there was no time to make new containers, so a system of packing the tape in empty black powder drums was developed. Thus the timesaving switch to 250-yard tape rolls was made quickly and easily.

This sort of practical engineering can help solve your problems too. Write Dept. 39 and set a time when trained sales engineers may consult with you on your problems.

A Product of

BAUER & BLACK

Division of The Kendall Company

2500 SOUTH DEARBORN ST., CHICAGO 16, ILLINOIS



RESEARCH TO SPEED AND
IMPROVE METHODS . . .
PRODUCTION SHORT CUTS
TO REDUCE COSTS



*This is the fellow
we are working for...*



...and millions like him

BUT KEEP THAT GUARD UP!

GENERAL MACHINERY CORPORATION

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THE NILES TOOL WORKS CO.

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GENERAL MACHINERY ORDNANCE CORPORATION

INCREASE PRODUCTION!



Du Pont Potassium High-Speed Copper Plating

IN COPPER PLATING, the way to greater production is through use of the Du Pont Potassium High-Speed Copper Plating Process. This is a development of the High-Speed Copper Plating Process so popular before the war and from which over 10 MILLION pounds of copper have been plated.

Standard Sodium baths (RH 553) can be converted easily and gradually to the new Potassium bath (RH 661) without changing equipment or interruption of plating operation.

Note these outstanding features:

1. HIGH SPEED—Smooth, impervious, uniform deposits of 0.001" or more in normal commercial operation—in 10-15 minutes! Plating at 40 to

80 AS/F, equivalent to 80 to 160 AS/F for bivalent solution!

2. HEAVIER, SMOOTH DEPOSITS—Smooth deposits from 0.002" to 0.003" or more may be obtained.

3. GREATER OPERATING ECONOMY—This is attained through lower metal concentration and lower cyanide consumption. Potassium Cyanide is more stable than Sodium Cyanide.

4. INCREASED PRODUCTION—The bath permits the use of considerably higher current densities with resultant higher rate of deposition and greater production per unit.

5. NO VENTILATION PROBLEM—No poisonous or objectionable fumes are evolved.

NEW OPERATING MANUAL—Complete instructions about installations, operation and maintenance of the Du Pont Potassium High-Speed Copper Plating Process (RH 661). Send for a copy. Du Pont Technical Service has had many years of experience with the installation and operation of plating solutions and will be glad to help in the development and installation of a suitable plating process to meet specific requirements. Just call or write our nearest district office. E. I. du Pont de Nemours & Co. (Inc.), Electroplating Division, Wilmington 98, Delaware.

*Conserve Plating Materials!
You need them! War needs them!*



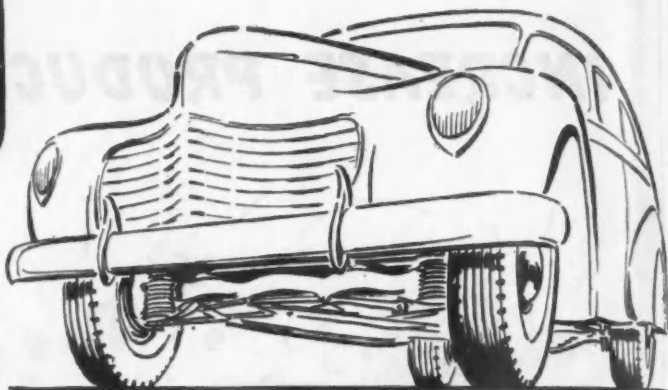
DU PONT CHEMICALS • PROCESSES • SERVICE

for **ELECTROPLATING**

Better Things for Better Living . . . Through Chemistry

PROVED

on *MILLIONS* of *Tubes in Service*



JENKINS CAPLESS TIRE VALVES **save rubber..save servicing time**

TIRE MEN *know* that a Jenkins Capless Tire Valve will meet the toughest operating tests because it has been proved — millions of times over — on tubes in every type of punishing road service.

This unique, modern tire valve pays off its users with unequalled savings in tires, time, and money. That's why tire and automotive engineers, service experts, and car owners give the Jenkins Capless Tire Valve their enthusiastic O. K.

No other tire valve offers the combined advantages of

this radically different design. It is the *only* valve that needs no cap to positively maintain correct air pressure, and thus stretch the mileage of scarce tires. And it's the *only* valve that matches the tube itself in true flexibility — that protects against ripping if the tire goes flat.

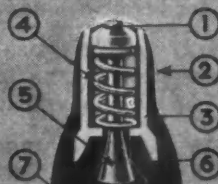
Whether you make, sell, or service tubes, there's a high sales and profit potential for you in the advanced design of Jenkins Capless Tire Valves. Get the complete story. Write Jenkins Bros., Rubber Division, 80 White Street, New York 13, N. Y.

NO OTHER VALVE HAS ALL THESE FEATURES

1. **NON-REMOVABLE VALVE HEAD** Needs no detachable cap to seal in air and maintain pressure.

2. **STANDARD SIZE TIP** Takes all types of air chucks, threaded or not.

3. **SHORT BRASS INSERT** "Welded" in the rubber — withstands severest conditions — does not impair flexibility.



4. **RUSTLESS STEEL SPRING** Resists corrosion — insures permanent seal.

5. **NICKEL PLATED PLUG** Smooth, rust-proof, self-cleaning.

6. **RUBBER SEAT** Insures positive seal with plug.

7. **TRULY FLEXIBLE STEM** Protects tube in case of a flat by receding through rim hole.

...and
**GUARANTEED
FOR TUBE LIFE!**
Every Jenkins Capless Tire Valve is guaranteed Air-Tight for the life of the tube to which it is originally and properly attached!

**TRULY
FLEXIBLE STEM!**



JENKINS *Capless* TIRE VALVE

SEALS AIR IN



SEALS DIRT OUT

MADE BY JENKINS BROS. ... MAKERS OF FAMOUS JENKINS VALVES

Wise farmers DON'T GAMBLE WITH BEARINGS



DEEP-GROOVE BEARINGS

Single row with deep, uninterrupted raceways permitting radial and thrust loads in either direction. Groove curvature conforms closely to balls, resulting in large contact areas.

CYLINDRICAL ROLLER BEARINGS

A single row of cylindrical rollers guided by flanges. Long contact surfaces between rollers and races. Also made with two rows of staggered ultra-precision rollers.



SELF-ALIGNING BALL BEARINGS

Self-contained. Their inherent property of alignment insures full capacity while compensating for any inaccuracies due to initial misalignment, shaft deflections, distortions or weave.

SPHERICAL ROLLER BEARINGS

Also self contained. Completely self-aligning for extra heavy radial and thrust loads or for severe shock conditions. Barrel-shaped rollers in a uniform path assure positive roller guidance.



These bearings never need adjustments... require only minimum lubrication.

SKF

Ball and Roller
BEARINGS

One or more
of these types
are used here—

The 1944 harvest holds too big a stake for America for farmers to gamble with its yield. Fewer harvest hands, higher wages, inexperienced operators are enough of a problem without machine tieups due to bearing breakdowns. So dealers everywhere are recommending reliable equipment like this No. 21 Reaper Thresher with its 38 SKF Bearings on differentials, fanning mill, cross conveyors, knife drives, table rollers, flywheel and other vital locations. Manufacturers, dealers and customers call "SKF" by name when they mention their bearing preference.

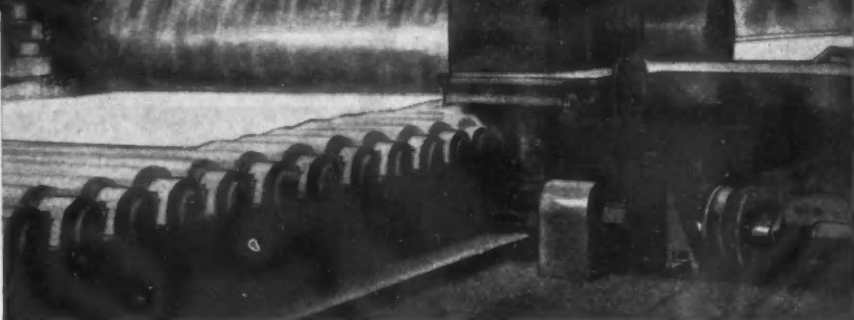
5442

SKF INDUSTRIES, INC., PHILA. 34, PA.



• The SKF Bearings on this No. 21 Reaper Thresher BUILT BY THE MASSEY-HARRIS CO., INC., work in enclosed cases and are effectively sealed against grit and dust. Properly lubricated, they last the life of the machine.

WHAT HAS THIS TO DO WITH *broaching?*



ONE of the earliest and most important engineering discoveries of all time was the lever, whose force potential moved a wise ancient to declare that . . . if given a lever large enough, and a star to serve as its fulcrum . . . he could move the world! Although, in its pure form, an earth-moving lever is impractical, the lever today performs, almost unrecognized, a multitude of useful functions. Its truly earth-moving potentialities are to be found in the lever's formula of power application . . . $\text{energy} + \text{ingenuity} = \text{efficiency!}$

It seems a far cry from the claw hammer to a huge rolling mill, where huge red-hot ingots are transformed as if by magic, into wafer-thin sheets . . . yet the principle remains constant. You couldn't beat out miles of thin steel plate with a carpenter's hammer . . . nor could you pull out a hard driven spike with your fingers. Both are examples of the lever's theory that a minimum of energy correctly applied can not only move the world . . . but can make the world a better place to move in.

BROACHING is a further development of this principle. Eliminating needless operations and speeding up production, it requires less energy to produce more . . . resulting in fewer man and machine hours to produce each part. Parts mass-produced in a fantastic variety of complex shapes and sizes to uniformly close tolerances. It will pay you to investigate the possibilities of broaching in your plant.

Just as Lapointe pioneered in the designing of broaches and broaching machines for the mass production of precision parts . . . so too, will Lapointe continue in its quest to make better things for a better world . . . quicker and cheaper!



Earliest use of broaching principle on this continent was by soldiers of the Revolution, who drove steel balls through heated rifle barrels to give the correct bore.



The **LAPOINTE**

Machine Tool Company

HUDSON, MASSACHUSETTS, U. S. A.

THE WORLD'S GREATEST AND LARGEST MANUFACTURERS OF BROACHES AND BROACHING MACHINES



They've got plenty
in Common!



SINEWS OF STEEL, tempered in a tough training course—plus ability to "take it" and come back for more—that's the U.S. fighting man. B-G-R Springs are fighting springs, too—toughened by heat-treatment to stand up in equipment of all kinds—designed for hard, reliable service. When you build for endurance—use B-G-R Springs.

ARMY NAVY

B-G-R Springs · Wire Forms · Small Stampings

BARNES·GIBSON·RAYMOND

DIVISION OF ASSOCIATED SPRING CORPORATION
TWO PLANTS FOR SPRING SERVICE
DETROIT and ANN ARBOR
MICHIGAN

B-G-R PRODUCTS SERVE
OUR COUNTRY—ON LAND,
AT SEA, AND IN THE AIR

How Much Does a Label Weigh?



YES, the label on a can of tomatoes. Not much more than a butterfly's wing. Yet, multiplied by the hundreds, the thousands, the hundred thousands, it means plenty. That's why one prominent canning company, in its efforts to support the government's paper conservation drive, is using a lighter weight of paper for its can labels. Yes, and using spot labels instead of wrap-around labels.

This is typical of the kind of paper saving manufacturers all over the country are now going in for. From cutting display material to the bone,

from redesigning packages and eliminating nests, partitions and interliners to writing on both sides of office stationery—manufacturers are continuously finding new ways to use less paper.

And, if the other fellow can do it — you can do it. Why not call a meeting today of your key executives and get your company going on a real peel-it-to-the-core paper conservation campaign. Remember, too, that baling waste paper and sending it to a reprocessing plant is a most important part of the job.

Remember—
**PAPER IS
WAR POWER**



USE LESS PAPER — SAVE ALL WASTE PAPER

This advertisement contributed by this publication and prepared by the War Advertising Council in cooperation with the War Production Board and the Office of War Information.

... The "Inside Story" of the JOHN CRANE Bellows PUMP SEAL

FLEXIBLE BELLOWS seals positively on grooved end flanges. Molded of special synthetic rubber, resistant to oil, water and anti-freeze.

SPRING maintains correct sealing pressure. Non-corroding.

SEALING WASHER, lapped flat. Has positive drive.

FERRULES assure even pressure distribution.

BELLOWS SEAL IS FURNISHED AS AN ASSEMBLED UNIT. . . . NOTE SIMPLICITY OF CONSTRUCTION.

Illustration shows typical installation in automotive water pump.

Note These Advantages:

- Spring and bellows are flexible—self-adjusting.
- Bellows and washer turn with the shaft; there is no wear on the bellows.
- Quick, correct installation is assured. Bellows assembly fits shaft loosely; slides freely into place, either end first (the two ends are identical).
- Service tests show the John Crane Bellows Seal operating perfectly after 100,000 miles and more.

Ask for Illustrated Bellows Pump Seal Bulletin.

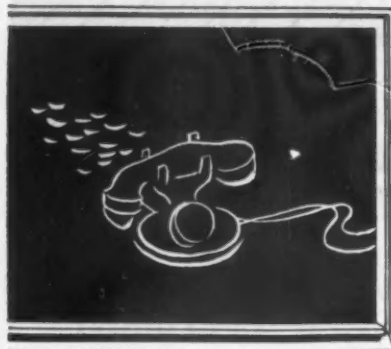
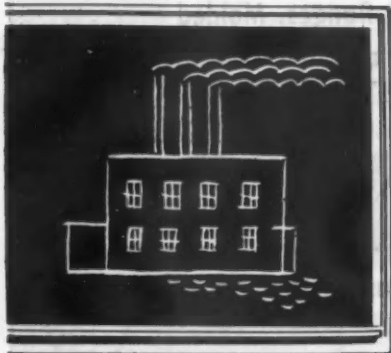
CRANE PACKING COMPANY

BALTIMORE, BOSTON, BUFFALO, CLEVELAND, DALLAS, DETROIT, HOUSTON, LOS ANGELES, NEW ORLEANS, NEW YORK, PHILADELPHIA, PITTSBURGH, SAN FRANCISCO, ST. LOUIS, TULSA

1818 CUYLER AVE. • CHICAGO 13, ILL.

CRANE PACKING CO., LTD., Hamilton, Ontario, Canada.
Branches: Montreal, Toronto, Vancouver

Want immediate delivery on felt cut parts?



use this single source

We control the product—from the raw material to the finished felt part. This single responsibility means constant supervision of all operation and assures uniform standards for each grade of felt.



depend on Felters' accurate cutting

Through the years, as we've learned more about cutting felt, we have designed and made many of our cutting machines and all our own dies... so that our customers can depend on Felters cut felt parts to be accurate in every detail—whether their order calls for 100 or 10,000.



and call on our experienced engineering advice

Our sales engineers are available to you for consultation on any design problems... or any other questions you may have concerning felt. We can also make recommendations, through our laboratory, both from a chemical and engineering standpoint. Write for our newest book, "Manufactured Felt Parts for Industrial Use." The Felters Company, 210-R South Street, Boston, Mass.

_____ put



in your post-war picture

BETTER THAN EVER!

for light-gauge metal welding

The
IMPROVED
AIRCO
No. 90-A
ELECTRODE

Made in 1/16", 5/64", and 3/32" sizes

IT'S especially designed for AC or DC welding of light gauge chrome-moly and similar steels used in aircraft construction. Made to a completely new formula, the Airco No. 90-A Shielded Arc Electrode provides these four notable improvements:

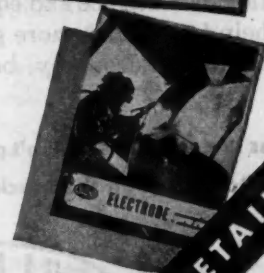
1. Better appearance of deposit
2. Stronger arc action
3. Reduced arc interference
4. Ability to work at higher currents without deterioration of coating at stub end.

And that's not all! This electrode is available in all three popular aircraft

welding sizes— $\frac{1}{16}$ ", $\frac{5}{64}$ ", and $\frac{3}{32}$ " diameters, 9", 12" and 12" lengths respectively. It is used with AC and is also satisfactory for DC operation, straight or reversed polarity.

Test specimens welded with Airco No. 90-A show tensile strengths of 80,000 to 90,000 psi. It meets the requirements of U. S. Army Air Corps Specification 10286B, Type I, Grade 2E, and conforms to A.W.S. and A.S.T.M. Specifications for Classification E 6013.

For complete details on the Airco No. 90-A, call or write any Air Reduction office. Or mail the coupon for prices and data on Airco's complete line of AC and DC electrodes.



MAIL COUPON FOR FULL DETAILS

★ BUY UNITED STATES WAR BONDS ★



AIR REDUCTION

General Offices: 60 East 42nd Street, New York 17, N. Y.
In Texas: Magnolia Airco Gas Products Co. General Offices: Houston 1, Tex.
Offices in all Principal Cities

Name.....

Company.....

Address.....

City..... State.....

- Please forward by return mail copies of—
- ☐ Airco Electrode Price List
 - ☐ Electrode Consumption Calculator

AA
Air
Reduction
Sales Co.

60 E. 42nd St.,
New York 17, N.Y.

WHAT IS VAPOR DEGREASING*?

VAPOR DEGREASING is the modern method for rapid and thorough removal of oil and grease from all types of metal products, plastics, glass and other materials. It utilizes the pure vapors of special degreasing grades of the non-flammable solvent, Trichlorethylene, and in some cases, Perchloroethylene. The degreasing process is extremely simple. It is carried out in scientifically designed equipment, built for efficient and economical operation.

In the degreasing process, the work may be given a preliminary immersion in boiling or warm solvent, or sprayed with clean solvent for mechanical removal of tenacious soil or solids. *But always, the final cleaning in any degreasing operation is the passage of the work through pure, uncontaminated solvent vapors.* This final rinse gives positive removal of the last traces of oil and grease, delivers the work clean, warm and dry, ready for inspection, assembly or finishing processes.

No other cleaning method can match the results obtained by vapor degreasing. Today it is widely used to meet wartime demands for faster production of ordnance and equipment. Tomorrow it will help to produce more goods—better goods—with maximum economy, because vapor degreasing—

BE INFLATION WISE! Don't pay more than ceiling prices!

Don't buy on the black market! KEEP PRICES DOWN!



**BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY**

E. I. DU PONT DE NEMOURS & CO. (INC.)

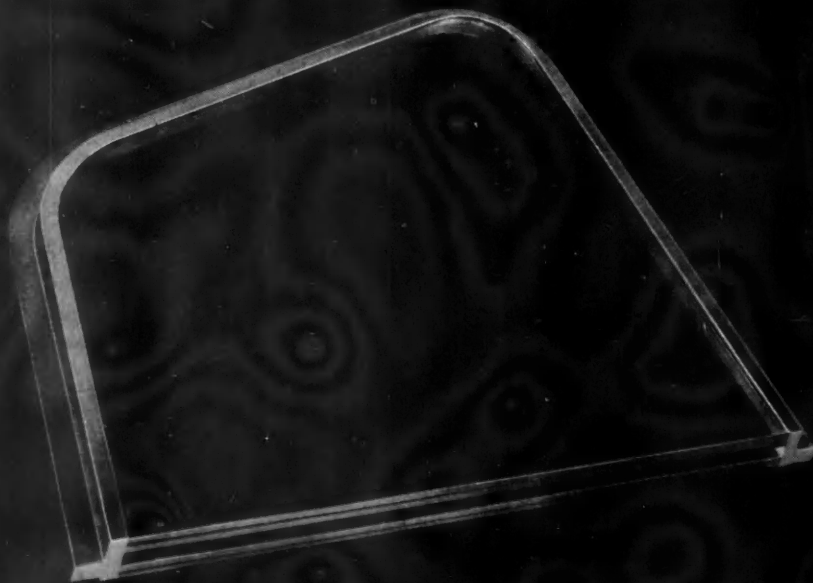
**Electrochemicals Department
Wilmington 98, Delaware**

- 1. Thoroughly removes grease** and oil from metal parts of any size or shape, usually in a minute or so.
- 2. Produces parts clean, warm and dry**—ready for inspection, assembly, further fabrication or finishing of any type.
- 3. Minimizes finishing rejects** because vapor reaches and removes grease and oil from deep draws, holes and places which are almost inaccessible.
- 4. Reduces risk** of damage to delicate parts.
- 5. Can be used alone** or as a part of a process flow line.
- 6. Utilizes compact equipment** that fits into small space.
- 7. Consumes only small quantities** of solvent. Contaminated solvent is recovered economically for re-use.
- 8. Uses the absolutely pure vapors** of a non-flammable solvent as a cleaning medium.
- 9. Simplifies cleaning procedure**, is easy to operate as a process.
- 10. Saves time and cost**—in its own operation, and in the subsequent handling and finishing of parts.

► *Vapor degreasing is basic for good metal cleaning. For each job there is a suitable cycle or combination of treatments. In every case, the final rinse in pure, uncontaminated solvent vapor assures positive removal of the last traces of grease and oil.

"PITTSBURGH" DEVELOPMENTS IN AIRPLANE GLASS

Double-Glazed Units for Vision Panels



THE PROBLEM: To preserve clear vision for pilots and bombardiers on heavy bombers, by substantially reducing condensation and frost formation on the glass surfaces of vision panels.

THE SOLUTION: A Flexseal Double-Glazed Unit was developed by Pittsburgh Plate Glass Company. As shown in the cross-section above, an air space is enclosed between two panes of glass. This dead air space serves as insulation, and tends to prevent condensation or frost formation upon the glass surfaces. Being of Flexseal construction, the unit for vision panels and bombardier windows has light weight, flexibility, and freedom from framing stresses.

No manufacturer has contributed more to the rapid progress made in the field of airplane glass and glazing than Pittsburgh Plate Glass Company. The development of the Flexseal Double-Glazed Unit is but one example from an impressive list of many contributions which have been

initiated by "Pittsburgh." If you would like further technical data on any aspect of airplane glass or glazing, we invite you to write us on your business letterhead. Address Pittsburgh Plate Glass Company, 2305-4 Grant Building, Pittsburgh 19, Pennsylvania.

"PITTSBURGH" stands for Quality Glass and Paint

PITTSBURGH PLATE GLASS COMPANY

Specialists in Airplane Glass

MAKERS OF DUPLATE AND FLEXSEAL SAFETY GLASS AND OF MULTIPLATE BULLET-RESISTING GLASS

September 1, 1944

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

167

PRECISION PARTS

THESE HAVE A BEARING ON THE LENGTH OF THE WAR



Inner bearing-races, perfectly machined, for an amazing instrument that speeds Allied progress and hastens total victory. They must be held to very close tolerances and carefully finished—and they must be turned out by the thousands on a mass-production basis.

Cut from stainless-steel tubing, the inside diameter and the back face of the flange are ground at the same setting. Then, placed on a mandrel locating from the inside diameter and the back face of the flange, the O.D. and the inside face are ground. Finally, the back face is reground to hold flange-thickness and overall length.

This kind of work is typical of Ace ingenuity. Here under one roof are the facilities and abilities to turn-out small parts and assemblies requiring stamping, machining, heat-treating, and grinding with speed and economy. Send sample, sketch, or blueprint for quotation.



A good booklet to have around. Send for a copy.



ACE MANUFACTURING CORPORATION
for Precision Parts



1241 E. ERIE AVE., PHILADELPHIA 24, PA.

PERSONALS

(Continued from page 54)

merly with Crosley Corp. and Cincinnati Precision Instrument Co.

Joseph S. Bennett, recently manager of sales of the American Engineering Co., has been elected vice president.

L. F. Weyand, general sales manager of the Minnesota Mining & Mfg. Co.'s Adhesive and Coatings Div. since 1936, has been promoted to general manager.

J. H. Maloney has been made advertising manager of the Detroit Diesel Engine Div. of General Motors Corp.

Ralph W. Hisey, vice president of The Osborn Mfg. Co. has been promoted to the position of vice president in charge of all manufacturing and engineering of both the brush and machine divisions of the company.

The Cleveland Graphite Bronze Co. has announced the promotion to district sales engineers of the following: **Norman A. Stocker**, **Charles L. Smythe** and **Arthur E. Gibbs**, all of the Service Engineering Dept.

Timken Roller Bearing Co. has appointed **R. G. Wingerter** assistant chief engineer for the Industrial Div.

W. A. Williams, associated with the Ford Motor Co. since 1925, has been named branch manager at Salt Lake City. New manager at the Ford Oklahoma City branch is **A. E. Klemmedson**, who has served in Los Angeles, Chicago, Dallas, and Omaha. **F. C. Richmond** has been named assistant manager of the Cleveland branch.

Edward C. Quinn has been appointed assistant sales manager of Dodge Div., Chrysler Corp. He succeeds **J. W. Hutchins**, who has resigned to take over a Dodge-Plymouth dealership.

Bendix Products Div. of Bendix Aviation Corp. has appointed **Allen C. Chambers** as director of automotive sales. He succeeds **Frank B. Willis**, who will assume full-time management of all Bendix Products war contract terminations and settlements.

Glenn C. Gillespie, for many years an active officer of the consulting engineering firm of **A. J. Brandt Co.**, Detroit, has been elected a director of National Tool Co. He succeeds the late **Arthur J. Brandt**.

A. P. Fontaine, formerly assistant chief engineer of the San Diego division of Consolidated Vultee Corp., has been appointed manager of the Stout Research division of the Corporation. He succeeds **A. E. Shelton**, recently transferred to the Allentown, Pa., division.

E. J. DelVecchio, formerly with the Taylor-Winfield Corp., has joined the Progressive Welder Co. as field sales manager. **Harry S. Rose**, formerly chief engineer, has been appointed sales manager for the Detroit district.

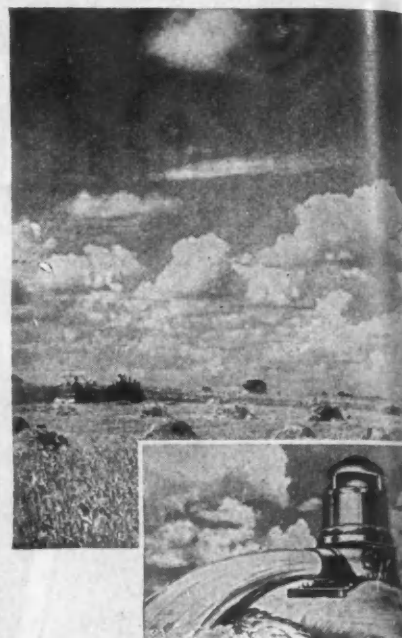
R. L. Willis has been appointed a sales engineer of the Tocco Process Induction Heating Div. of the Ohio Crankshaft Co. He formerly was assistant manager of sales of the Structural and Bar Div. of the Weirton Steel Co.

W. F. Armstrong, special assistant to **Albert Bradley**, executive vice president of General Motors Corp., has been elected a vice president of the corporation. He succeeds **Thomas P. Archer** in charge of the manufacturing staff and will continue as chairman of the War Contract Termination Committee of the Central Office staff.

Arch F. Campbell has been appointed manager of the new branch office established at Tulsa, Okla., by the Detroit Diesel Engine Div. of General Motors Corp. He formerly was associated with the Clark Bros. Co., Inc., Div. of Dresser Industries.

Neal Nyland has resigned as director of advertising and sales promotion for Nash-Kelvinator Corp. to take a position with Benton and Bowles, New York advertising firm.

C. W. Perelle, formerly vice president in charge of manufacturing for Consolidated Vultee Aircraft Corp., has resigned to take a position as an official of the Hughes Tool Co., Houston, Texas.



It's The "Pay Off" That REALLY COUNTS

Getting right down to facts, you can't count a farm's yield by its acreage; a factory's output by its floor area, nor a water system's gallon capacity by its well diameter. It's the "pay off" in each that really counts.

It just so happens that Layne Well Water Systems have the very best "pay off" that engineering skill has yet achieved. For such efficiency there are many good sound reasons. First and foremost is the sixty-two year record of constant endeavor in the well-drilling and pump building field. Second is the meticulous care with which each system is built and installed, and third is Layne's unbroken policy of making no compromise with quality.

Many are the cities, factories, paper mills, chemical plants, packing houses, breweries, irrigation projects and mines who use Layne Well Water Systems almost exclusively. They all know that back of every Layne Well Water System there stands the largest, most widely experienced and constantly dependable ground water developing organization in the world.

If in a Well Water System it is the "pay off" in which you are interested, write for late literature. Address Layne & Bowler, Inc., General Offices, Memphis 8, Tennessee.

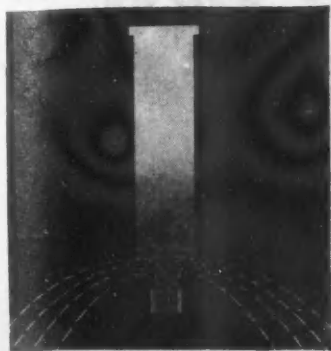
AFFILIATED COMPANIES: Layne-Arkansas Co., Stuttgart, Ark. * Layne-Atlantic Co., Norfolk, Va. * Layne-Central Co., Memphis, Tenn. * Layne-Northern Co., Milwaukee, Ind. * Layne-Louisiana Co., Lake Charles, La. * Louisiana Well Co., Monroe, La. * Layne-New York Co., New York City * Layne-Northwest Co., Milwaukee, Wis. * Layne-Ohio Co., Columbus, Ohio * Layne-Texas Co., Houston, Texas * Layne-Western Co., Kansas City, Mo. * Layne-Western Co. of Minnesota, Minneapolis, Minn. * International Water Supply Ltd., London, Ontario, Canada



WELL WATER SYSTEMS
DEEP WELL PUMPS

BUILDERS OF WELL WATER SYSTEMS
FOR INDUSTRIES AND MUNICIPALITIES

A new yardstick for measuring steel characteristics and response to heat treatment . . .



END QUENCH HARDENABILITY BANDS

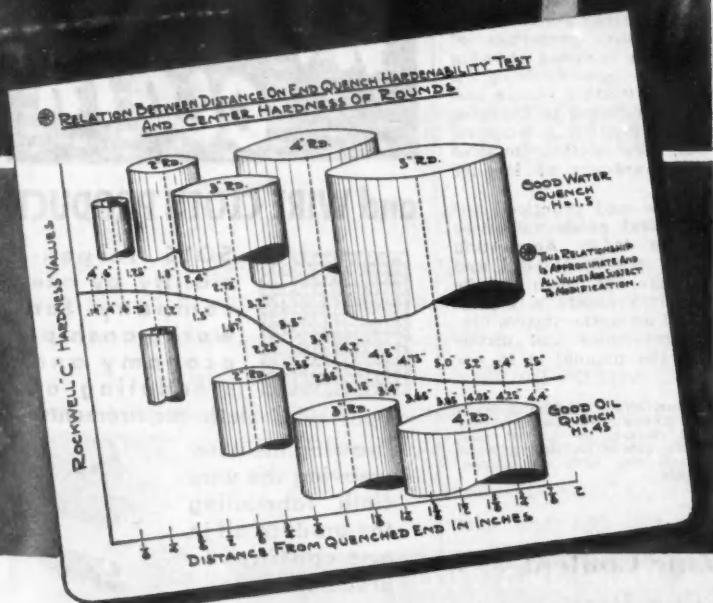
THE End Quench Hardenability Test devised by Jominy and standardized by SAE has now been accepted as a convenient measure of certain steel characteristics.

With the proper technique and experience the results of this test serve as a criterion of (1) *depth of hardening*—a function of carbon and alloy content; (2) *maximum "as quenched" hardness obtainable*—a function largely of the carbon content. (The depth of hardening can be further translated into a measure of the size of section in which the superior mechanical properties of the fully hardened and drawn microstructures can be secured.)

As the principles of hardenability have become better understood and the value of the proper use of hardenability data has been more fully realized, the possibility of incorporating into specifications certain hardenability limits has been increasingly suggested as a means of better control of steel and steel products. Such limitations are now available in the form of hardenability bands for some of the commonly used alloy steels which are designated as "H" steels.

The specification of "H" steels will provide the user, it is predicted, with material of enhanced uniformity with respect to those characteristics of which the end quench hardenability test is a criterion. Two of the more important of these characteristics comprise the maximum quenched hardness and the hardening to a depth necessary to assure the final desired mechanical properties.

Our metallurgists have been in the very forefront of this development and are ready to discuss with you the possibilities of hardenability studies as applied to your measurement of steel characteristics.



U.S.S. Carilloy Alloy Steels

CARNEGIE-ILLINOIS STEEL CORPORATION

Pittsburgh and Chicago

Columbia Steel Company, San Francisco, Pacific Coast Distributors · United States Steel Export Company, New York



UNITED STATES STEEL

Rawhide

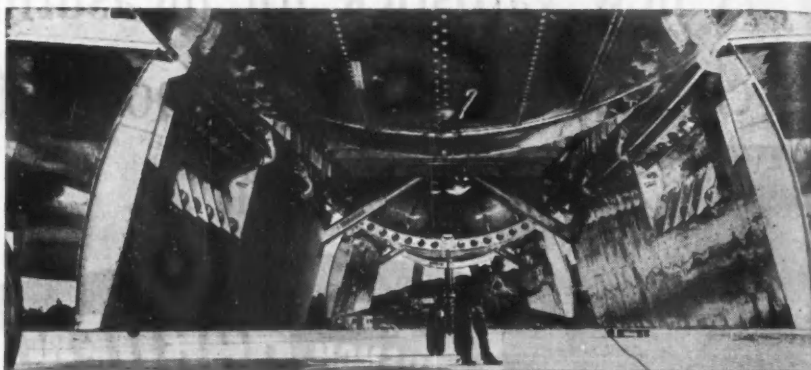
PROTECTS

The tough, resilient, coiled rawhide faces of C/R Hammers and Mallets strike effective blows without battering or marring... protects finished surfaces, machines delicate insulation and parts. Speed die-setting, assembly, no fatiguing re-coil. Reduce breakage and spoilage. Sizes and weights for every need.

C/R Hammers have permanent malleable iron heads which take replaceable insert faces of mechanical rawhide.



CHICAGO Rawhide MFG. CO.
1310 ELSTON AVE. ★ CHICAGO, ILLINOIS.



B-29 Superfortress Has Two Bomb Bays

An unusual feature of the Boeing Superfortress is the alternating system of dropping its bombs. Both of the B-29's bomb bays could not be located at the planes center of gravity, so one was placed forward of that point and the other aft. To

prevent throwing the plane temporarily out of level flight, which would occur if one bomb bay were emptied before the other, Boeing engineers designed a mechanism which drops a bomb alternately from one bay and then the other.

Publications

(Continued from page 56)

Glue which is used extensively in the commercial bonding of wood, paper, fabrics, cork, etc.*

Landis Machine Co. has issued a new booklet, **More Production From Landis Chasers**, which is designed to help get maximum production from Landis tap and die chasers.*

A basic textbook on the properties and uses of soluble nitrocellulose, base for plastics, lacquers, coater textiles and many other products, has been published by Hercules Powder Co.'s Cellulose Products Dept. Written in two parts, part one begins with a discussion of the history of nitrocellulose, contains a section on properties which includes chapters on the manufacture, types, solubility, viscosity and other pertinent information on the unusual properties of nitrocellulose. Tables are included showing nitrogen and viscosity specifications, a blending chart and many other charts and graphs. Section two is devoted to the uses of nitrocellulose, its application in lacquers, coated textiles, etc. The section includes tables showing the hardness of lacquer films, tests, etc.*

Accounting principles and practices approved for use in capital goods industries are described in the **MAPI Accounting Manual** published by the Machinery and Allied Products Institute, 221 North LaSalle St., Chicago 1, Ill. It presents a typical chart of accounts and an authoritative discussion of related principles and procedures. The price of the manual is \$5 per copy.

* Obtainable by subscribers within the United States through Editorial Dept. AUTOMOTIVE and AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

Maintains Zinc Content Of Idle Plating Bath

A new method of preventing the loss of metal from the zinc anodes in plating baths during off hours—by passing a weak current in a direction opposite to the plating current—has been developed in the research laboratory of E. I. du Pont de Nemours & Co.

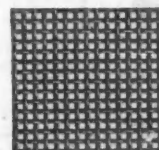
During the course of investigation of zinc plating, it was discovered that

a small counter current applied between a zinc anode (as cathode) and a steel plate in the bath (as anode) is highly effective in eliminating chemical attack of the zinc.

For most installations, only a two-volt storage battery, charged constantly with a small rectifier, suffices. The total current required for a 1000-gal. still tank is approximately 1½ amperes, and a 1000-gal. barrel tank with more anodes requires about 2½ amperes.

WIRE CLOTH

and WIRE CLOTH PRODUCTS



SOLE responsibility by one company for workmanship, economy and scheduling of

your wire cloth requirements.

Drawing the wire, weaving the wire cloth, fabricating the product, all in one continuous production line.



Send Michigan Your Inquiries

Established 1860

MICHIGAN WIRE CLOTH CO.

2100 HOWARD • DETROIT 16

Have you a

REMOTE CONTROL

problem?

SPERRY'S EXACTOR HYDRAULIC CONTROL MAY SOLVE IT

Sperry's EXACTOR HYDRAULIC CONTROL, by means of a flexible, unique, single-tube system, has solved hundreds of remote control problems for design engineers in many industries.

Accurate and self-contained, requiring no special engineering to install or maintain, the EXACTOR HYDRAULIC CONTROL is well worth investigating.

Installation is simple and quick, because the EXACTOR uses tubing that can be bent around obstacles — thus eliminating all design problems. If you have a control problem involving the accurate transmission of applied motion over distances up to 200 feet, send for our completely descriptive booklet.

Sperry's EXACTOR HYDRAULIC CONTROL is rated at 400 inch-pounds on the pressure stroke and 100 inch-pounds on the spring-return stroke.

FILL OUT AND MAIL COUPON BELOW • NO OBLIGATION

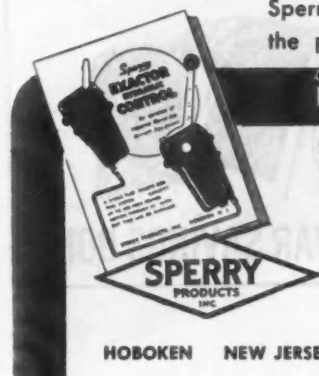
**SPERRY PRODUCTS, INC.
HOBOKEN • NEW JERSEY**

A.A. EHC-944

Gentlemen: Please send me, at no cost, a copy of your Bulletin 78-D containing complete details on your EXACTOR HYDRAULIC CONTROL.

NAME _____ TITLE _____
COMPANY _____
ADDRESS _____ CITY _____ STATE _____

HOBOKEN NEW JERSEY



Handle the
BIG JOBS
*Easily
and
Safely*



C-F POSITIONERS

With C-F Positioners each welder can position even the most cumbersome weldments with a push button control—without crane work or handling crews. He can rotate the weldment a full 360°, rotate it at any speed from 0 R.P.M. up and can tilt it to 135° beyond horizontal . . . can weld all sides, surfaces and angles down-hand with a single set-up; with larger rods and fewer passes. All C-F Positioners, both stationary and portable, are pedestal mounted to give maximum floor and working clearance; all are adjustable for height.

Write for Bulletin WP-22

CULLEN-FRIESTEDT COMPANY
1322 S. Kilbourn Ave. Chicago 23, Ill.



BOOKS

HIGH SPEED COMBUSTION ENGINES (12th Edition) published by P. M. Heldt, Nyack, N. Y. This new edition is the first complete revision since 1938. Obsolete material has been deleted and replaced by recent developments in this broad field. The extent of revision may be gaged from the fact that 50 of the approximately 500 illustrations are new. Up-to-date material has been added particularly in the chapters on Engine Blocks, The Connecting Rod, Crankshaft and Flywheels, Valve Actuating Mechanisms, Water Cooling, Air Cooling, Manifolds and Mufflers, and Engine Tests. In the Eleventh Edition a chapter on Unconventional Engines (two-stroke, sleeve-valve, rotary valve, radial, rotary, double rotary, and barrel-type) was added, and the chapter is continued in this new edition.

"STRESS ANALYSIS FOR AIRPLANE DRAFTSMEN," by Ernest J. Greenwood and Joseph R. Silverman, Chance Vought Div., United Aircraft Corp., is a text book providing draftsmen with the necessary tools for the solution of many structural design problems of everyday character. In the practice of elementary stress analysis it is hoped that design draftsmen may be encouraged to acquire a more thorough knowledge of engineering and design. The text pursues in logical order—analysis of design loads on airplanes, statics, center of gravity and moments of inertia, beam theory, spring theory, fatigue stress concentrations and combined stresses. The authors have aimed at a well rounded treatment of the subject to the end that designers may be enabled to do their job better. Published by McGraw-Hill Book Co.; 291 pp.



Electronic Heating Sets Twist in Tire Cord

All rayon tire cord manufactured by Industrial Rayon Corporation is subjected to electronic heating in a new process developed by the company's technical staff to solve problems in the twist-setting of textile yarns.

The twist of the rayon tire cord is set by placing packages of the cord in a high frequency electrical field. Heat generated in the cord by this operation is distributed so uniformly that cones containing 18 pounds or more of rayon tire cord may be effectively treated. Such giant cones are used in the web-less method of tire construction.

"Every dime and dollar not vitally needed for absolute necessities should go into WAR BONDS and STAMPS to add to the striking power of our armed forces."

—President Roosevelt

EVERYBODY
EVERY PAYDAY

10%

IN WAR BONDS

★ ★ ★ ★ ★ ★ ★ ★

New Goal for Payroll Savings Plan!

Along with increased war production goals go increased costs: \$1 extra billions which must be raised, and raised fast, to win this war.

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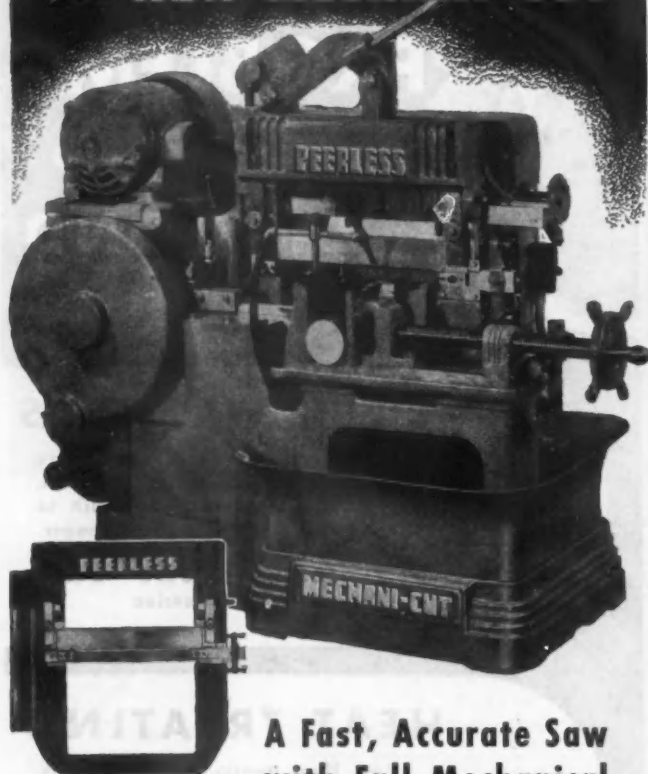


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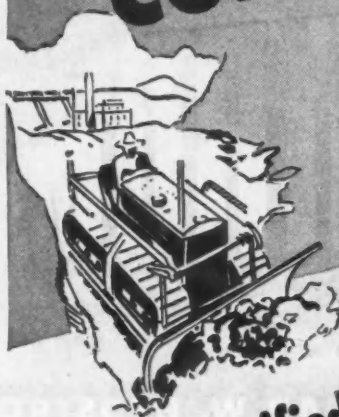
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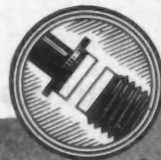


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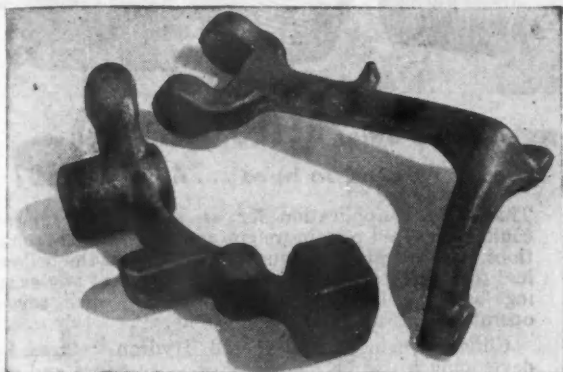
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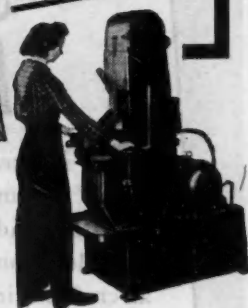


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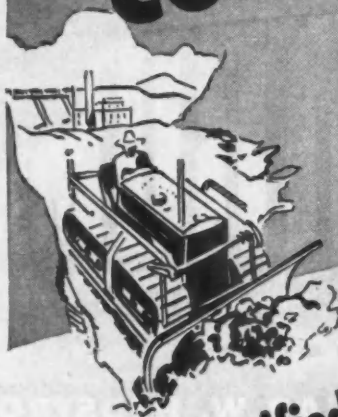


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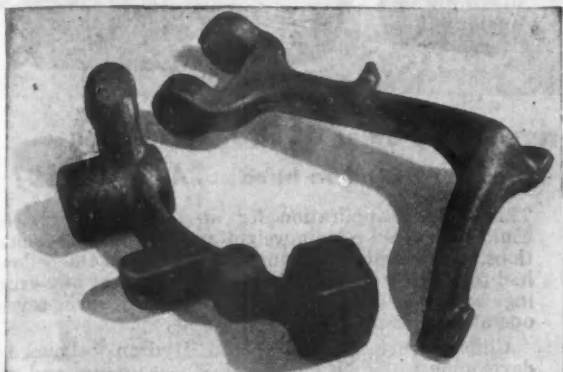
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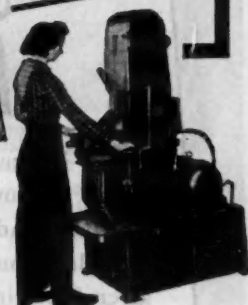


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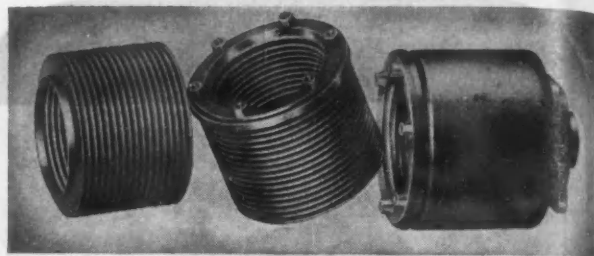
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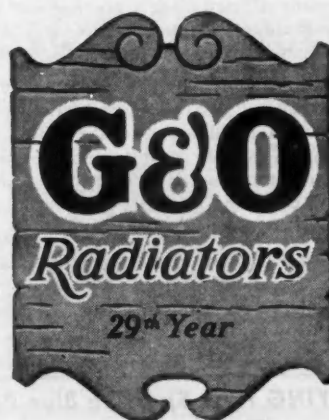
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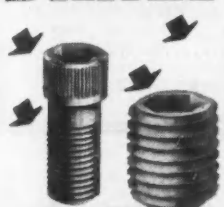
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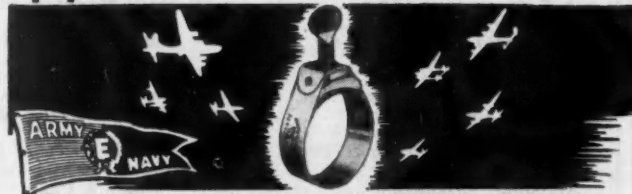
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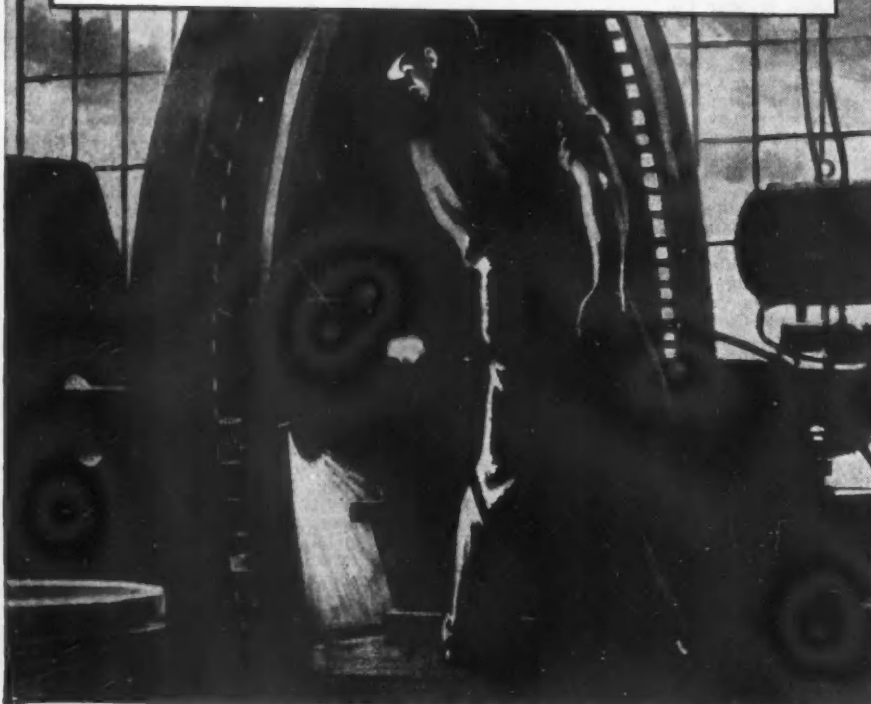
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| McQuay-Norris Mfg. Co. (Aircraft Div.) | — |
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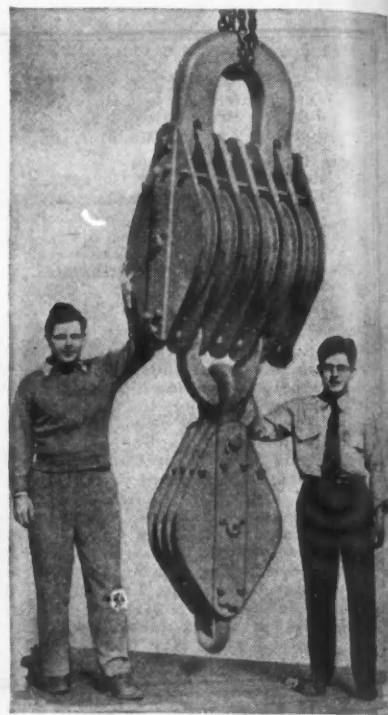
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IN THE NEWS

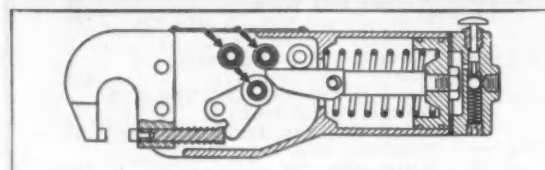
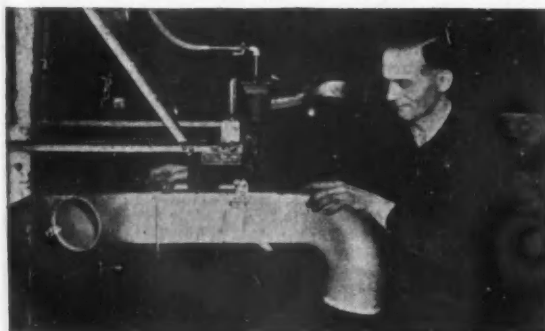
WITH TORRINGTON BEARINGS



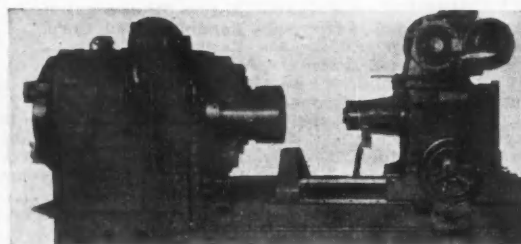
ALL IN THE DAY'S WORK typifies the attitude of Torrington engineers when they undertake the design and manufacture of anti-friction bearings for new or unusual applications. The skilled workman shown in the illustration is grinding the race for a precision bearing 10 feet in diameter, with a tolerance of two-thousandths of an inch. When you need counsel on standard or large, custom-built bearings, **TURN TO TORRINGTON.**



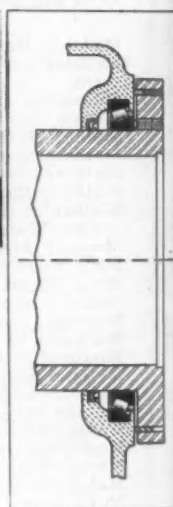
LIFTING 125-TON LOADS is the job of these tackle blocks designed and built by the Downs Crane & Hoist Company. With one block employing six sheaves, the other three, they are used in tandem to reeve the 19 parts of one inch wire rope required to sustain the load. Two NCS Needle Bearings, supplied by Torrington's Bantam Bearings Division, were installed in each of the sheaves which revolve on a 3" hardened and ground shaft, with the pin hollow bored for pressure lubrication. NCS Needle Bearings combine the advantage of high load capacity and compact design with ease of installation.



THIS CINCINNATI PNEUMATIC Squeeze Type Riveter, with a 3-ton compressive force, manufactured by the Schauer Machine Company, provides an interesting application for Torrington LN Needle Bearings. Selected because of their compact design and high load capacity, the bearings were installed, as shown in the accompanying cross-section, at the points where pressure is extremely high.



MILLING THREADS in 8" howitzers and 155 mm. guns is part of the important work performed by this Master Thread Miller, manufactured by the Smalley-General Company. To provide the essential accuracy at high speeds, and to take up the very heavy radial and thrust loads, both main and milling spindles are mounted in Tapered Roller Bearings, 30" O.D., as shown in the accompanying cross-section. Eccentricity and face run-out of these bearings is .0005 maximum—an example of the ability of Torrington's Bantam Bearings Division to build precision bearings for heavy-duty applications.





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